# GRINDING and FINISHING

JANUARY·1960

EXCLUSIVE:

# LEADERS PREDICT:

# INDUSTRY DEVELOPMENTS for 1960

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...s Corp. • Mattison Machine Works • Carbo
Exolon Company • Roto-Finish Company • Size Con
... Inc. • Koebel Diamond Tool Co. • Ex-Cell-O Corporation
...pany • General Abrasive Company, Inc. • Fox Grinders, Inc. •
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...mpany • Micromatic Hone Corporation • Behr-Manning Co. • Brow
...oratory • Michigan Abrasive Company • Merit Products, Inc. • Norto
... Division • Precision Grinding Wheel Company • DoAll Company • Bay St
...cts, Inc. • United States Rubber Company • Harig Manufacturing Corpor
...Company • Sunnen Products Company • Timesavers Sanders • Peninsu
...tor Tool Company • Airborne Instruments Laboratory • Macklin Co. •
...Company • Minnesota Mining and Manufacturing Company • Cortlan
... Chicago Rubber Company, Inc. • Peninsular Grinding Wheel Division
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Machine Company • Hammond Machinery Builders Inc.
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...oration • Taft-Peirce Manufacturing Company • Cin
...pany • Brown & Sharpe Manufacturing Company •
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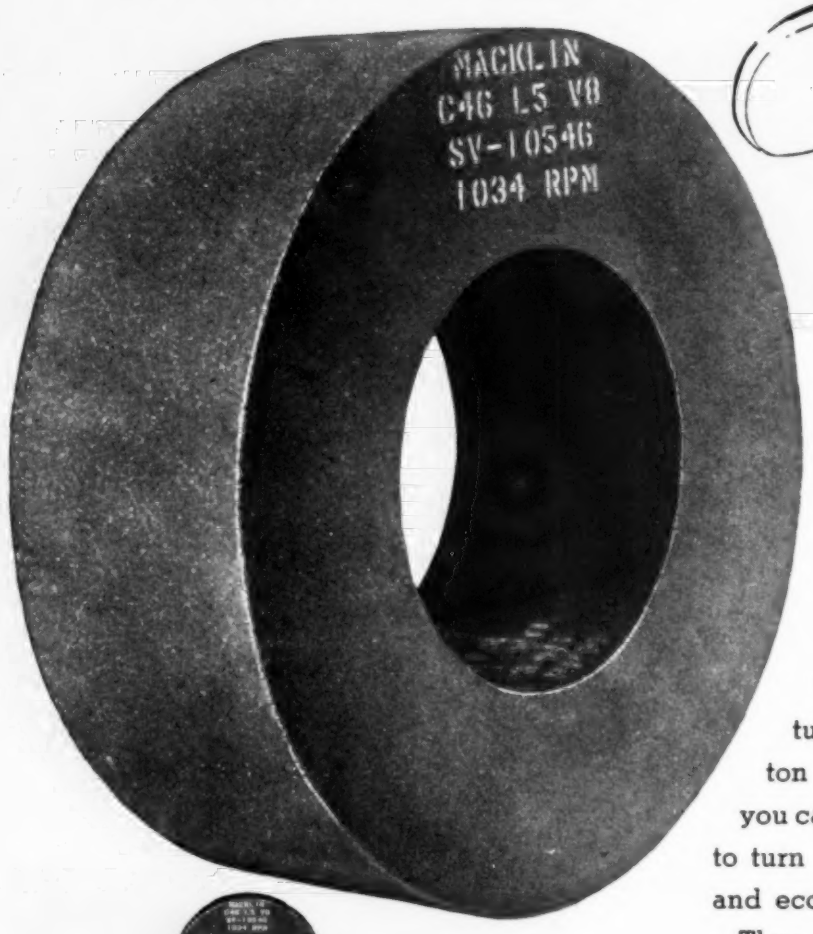
# CENTERLESS

## *"Wheels of Profit"* by MACKLIN



MACKLIN Centerless Wheels are available in a complete range of sizes and gradings. Standard and special regulating wheels are also available.

for uniform,
**HIGH SPEED PRODUCTION**

Whether you finish bolts, bars, rods or tubes . . . bearings, tappets, pistons or piston rings . . . twist drills or plastic parts . . . you can depend on Macklin centerless wheels to turn out *identically* ground pieces quickly and economically.

They cut cool and sharp. They have good balance. Uniform dispersion of abrasive grain through the wheel enables you to hold part size uniformly and to obtain good finish.

### HERE'S PROOF

**ROUGH GRIND PINION SHAFT** "Good stock removal. Finish excellent. Have standardized on this wheel." 20x6x12 C60 L5 V8

**FINISH HIGH SPEED CARBON DRILLS** "Wheel very satisfactory. Production increased materially." 20x8x12 18A 100 N5 V6

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GRINDING WHEELS

MACKLIN company **Dept. 63 Jackson, Michigan**

WHEREVER ABRASIVE OPERATIONS ARE PERFORMED

# GRINDING and FINISHING

CONTENTS FOR JANUARY • 1960 • Vol. 6 • No. 1

Feature Articles

**30 "Bubble" Wheels for Soft Non-Metallics**
Successful molding of alumina bubbles into wheels opens possibilities for expanding wheel applications in the grinding of rubber, plastics, cork and similar materials for which loading has been a problem with standard wheels.

**34 The State of the Industry**
Direct quotations from leaders in the field of abrasive manufacture—bonded abrasives, coated abrasives and grain—together with leading builders of grinding machines and accessories as to the outstanding developments of 1959 and the outlook for 1960. Second annual exclusive report on what's going on in grinding and finishing.

**41 Detroit Broach Eliminates Burning, Loading with Wheel Treatment**
In the highly competitive field of tool manufacture every operation is under close and constant scrutiny. Use of a new wheel treatment eliminated burning and loading, saved man hours, extended wheel life at Detroit Broach.

**43 Slash Costs with Flat Polishing**
Flat polishing with abrasive belts, once considered only as a high-volume process for large companies, emerges as a flexible and highly economical stock removal and finishing process for medium and small plants as well.

**46 Standard Time Data for Grinding—Part II**
The second section of this revision of a highly successful series covers the application of standards to large surface grinding operations of the Blanchard type.

**52 Right-Size Wheels Cut Grinding Costs**
Many grinding wheel users spend more for grinding wheels than they need to, simply because they buy non-standard wheels, or the wrong sizes of standard wheels, or fancier shapes than they really require. A review of the sizes and shapes you are buying, along the lines suggested, should save you real money without increasing hazards.

Departments

**4** Letters
**9** Editor's Page
**13** Design for Grinding
**16** Metalworking in General
**19** Sam Safety
**21** You Asked
**25** American Society for Abrasives
**29** Ideas from the Shop
**57** Literature
**63** Equipment and Materials
**73** News of the Industry
**81** A Final Thought

**JANUARY COVER:** While the crystal ball is used as the symbol of the opinions and the comments of industry leaders, their statements have a much more solid foundation in the market research and the interpretation of trends by men who have spent years in the broad field of abrasives and grinding machines and accessories.

Subscription rates: $6.00 per year in U.S.A. $7.50 per year elsewhere.
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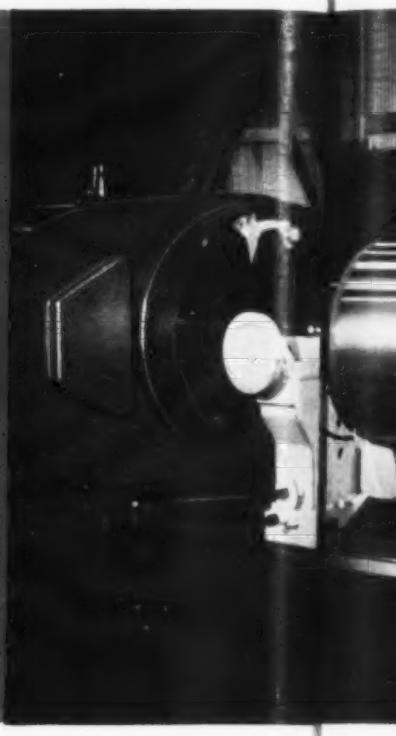
Phone MOntrose 5-1000. Cable address: HITCHPUB Accepted as controlled circulation publication at Pontiac, Illinois.

## CINCINNATI GRINDING MACHINE DIVISION

# Builds 10″ to 60″

*for grinding Sendzimir Mill Rolls*



Small diameter, slender rolls are ground to the highest quality finish and accuracy on CINCINNATI FILMATIC 10″ Roll Grinding Machines.

Grinding a perfect crown on medium-sized rolls of any practical length. The machine for this job is a CINCINNATI FILMATIC 20″ Traveling Table Roll Grinder. *(Photo courtesy Kaiser Aluminum & Chemical Corp.)*

BRIEF SPECS

| Sizes and types | Cambering equipment | Catalog |
|---|---|---|
| 10″, three lengths, traveling table | sine bars | G-714 |
| 18″ and 24″, six lengths, traveling table | tilting wheelhead | G-709-1 |
| 24″ and 28″ heavy duty, five lengths, traveling table | tilting wheelhead | G-587-1 |
| 28″, 36″, 44″, 50″, 60″; eight lengths, traveling wheelhead | tilting wheelhead | G-700 |

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THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI FILMATIC

# range of fine Roll Grinders. . .

Big rolls, dwarfing the operator, are ground on a CINCINNATI FILMATIC 60" x 312" Traveling Wheelhead Roll Grinder. *(Photo courtesy Kaiser Aluminum & Chemical Corporation)*

First impressions are lasting. And for anything passing between the rolls of a rolling mill, so are *last* impressions. That's why the finest sheet mill products come off rolls ground on CINCINNATI FILMATIC Roll Grinders. These machines are built in dozens of sizes and lengths, accommodating every type of roll imaginable. There are three general types:

1 For the *smaller* rolls, traveling table type with double sine bar cambering equipment

2 For *medium-sized* rolls, traveling table type with tilting wheelhead cambering equipment

3 For *large* rolls up to 100 tons, traveling wheelhead type with tilting wheelhead cambering equipment

All CINCINNATI FILMATIC Roll Grinding Machines have the power to remove metal rapidly, and ample rigidity to assure the finest finish. They incorporate many features of dependability . . . all are equipped with FILMATIC grinding wheel spindle bearings, the only self-adjusting, no-maintenance spindle mounting. Medium and large sizes are equipped with automatic wheel speed regulation. A unique equalizing roll driver assures accurate true-center rotation of the roll.

Considering all the advantages, Cincinnati is your first choice for the roll shop. Our Roll Grinding Specialists will be glad to visit your shop and give you firsthand information. Meanwhile you may want one of the catalogs tabulated in the spec table.

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. . . if finishing costs are eating up your profits and you can't find help, let United States Diamond Wheel Co. show you how on-the-job "PROGRESSIVE SPECIFICATIONS" has saved others. PRESSURELOK® builds optimum performance into every diamond wheel—yet your carbide cutting costs may be reduced by using different type, size, grit or hardness of wheel from the one which you are now using. Here's how we can warrantee you top carbide cutting efficiency.

**PRESSURELOK WORKS BEST!**
PRESSURELOK (the Performance bond) makes the best of Diamond wheels because it scientifically combines warranteed amounts of graded Diamonds distributed in constant density throughout a perfect bond which wears uniformly at the ideal rate of Diamond usage.

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# Editor's Mail

## Gaging Series

The first article of Mr. McKee's forthcoming series on gaging has been the subject of many favorable comments among our staff, both Engineering and Sales. I would like personally to compliment Mr. McKee and his associates for a treatment of this important subject which has long been overdue.

The treatment and content of Mr. McKee's first article indicates to me that the complete series will be a very valuable aid for the initial training of sales and engineering personnel whose previous experience has been in other, although allied, lines . . . We . . . intend to incorporate them in a training manual now in preparation. I would also appreciate your advising me of the approximate cost of 200 sets of the complete article.

**R. B. Schofield**
**Airborne Instruments Laboratory**
**Mineola, N.Y.**

Please send me five sets of the series of articles "The How and Why of Gaging."

**M. L. Brown**
**Project Engineer**
**Steatite Division**
**American Lava Corp.**

Our organization is interested in obtaining copies of "The How and Why of Gaging." This article appeared in the August, September, October and November 1959 issues of the GRINDING and FINISHING magazine.

At this time we are primarily interested in obtaining the following information:

a. Price breakdown in lots of 25, 50 and 100.
b. Approximate delivery schedule.

**John McGerty**
**Quality Control**
**Strator Division**
**Fairchild Engine &**
**Airplane Corp.**

**Reprints of this series will be available by the end of January. The cost will be $1.00 each in quantities of less than 25. In quantities of 25-$20.00, 50-$30.00, 100-$40.00.**

## April 1959

An article appeared in the April 1959 issue of "Grinding and Finishing" that is of considerable interest to us.

Could you send us a copy of this issue?

**Ed Bowman**
**Plant Manager**
**Altamil Corp.**
**El Segundo, Calif.**

**We will be happy to send any issues you may request as long as they are available.**

**Thank you. We hope every one approves and benefits.**

## Coolant Cleaning

Thanks very much for the reprints of the series of four articles titled "The Cleaning of Grinding and Finishing Coolants". . .

These articles are in our opinion clear, concise, to the point, well illustrated, and well done. It is our company policy to bring information such as this to the attention of "people with problems" among the trade on whom we make sales calls.

Your offer to send us a dozen or so copies of your reprint is very much appreciated.

**A. F. Hudson**
**Hudson Tool Service, Inc.**
**Huntington, Ind.**

## THE GRINDING WHEEL

We contacted the American Consulate General's office in Calcutta with the view to obtain some technical information on above subject and have gone through your publication of a monthly journal GRINDING and FINISHING very carefully.

We had also had the opportunity to review the contents of your publication of a textbook entitled "The Grinding Wheel" in the May, 1959 issue of your journal.

It occurs to us that your above book and the journal mostly deal with the application of grinding wheels and their specific uses in different kinds of jobs.

We are actually interested in obtaining a book or journal which deals with

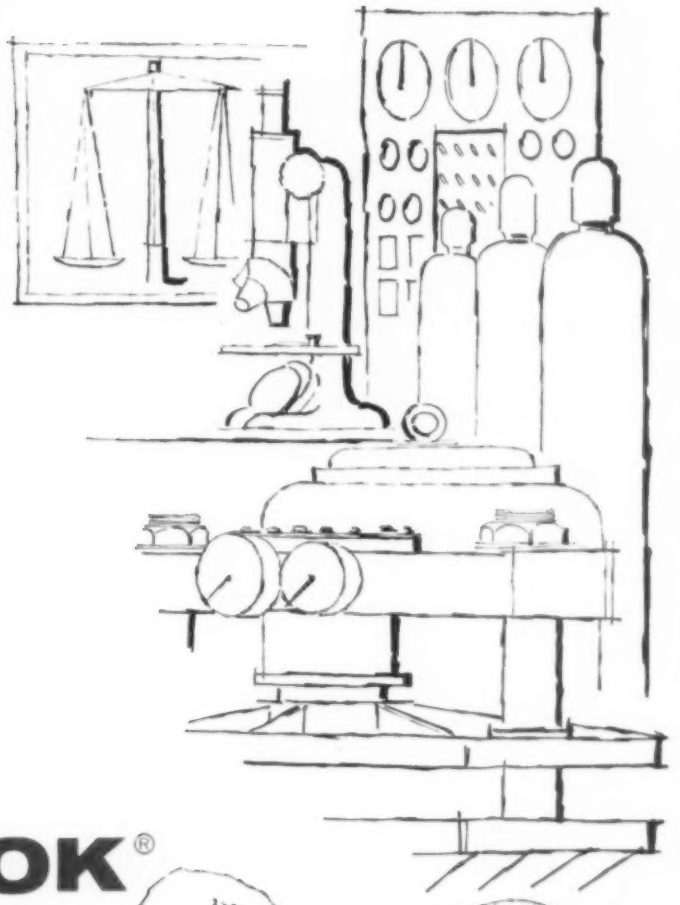
# MD or

(MAN-MADE DIAMONDS)

# SND

(SELECTED NATURAL DIAMONDS)

## both work **BEST** in **PRESSURELOK**®



All of the new developments in Diamond bonding and processing are available *now* for use in your plant. The United States Diamond Wheel Co. makes the world's best wheels with man-made or natural Diamonds.

"Progressive Specification" insures the best use of all the newest techniques and materials by on-the-job engineering.

Since the efficiency of either MD or SND is determined by the ability of the bond to present friable surfaces of the Diamond to the work surface, it should be readily apparent that PRESSURELOK Bond, which has 300% more Diamond holding power than other resinoid bonds, reduces carbide cutting costs over any other make of Diamond wheel.

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**Phone: TWinoaks 7-9181**

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## LETTERS *(continued)*

the manufacture of bonded and paper abrasives.

We shall be very much obliged if you would kindly let us know, by return mail, if you have any such book and the price of same so that we may purchase it direct from you.

In case you do not have any such book please let us know if possible the names of other publishers in the U.S.A. whom we may contact for such a book.

**Manaranjan Bhar**
**National Engineers & Traders**
**Calcutta, India**

**The two part series which ran in the September and October issues of GRINDING and FINISHING are recommended in answering this request for manufacturing information, This series is titled "What You Should Know About Wheel Manufacturing."**

**Additional information can be obtained by writing the American Ceramic Society Bulletin, 4055 N. High St., Columbus 14, Ohio.**

### Also Wheel Manufacturing

Would you be good enough to send 6 reprints of your article "What You Should Know About Wheel Manufacturing." It started in your September issue.

Also could you tell me where I could get 6 reprints of "On the Basic Mechanics of the Grinding Process" by R. Backer and M. C. Merchant.

**E. B. O'Connor**
**O'Connor Abrasive Sales**
**Buffalo, N.Y.**

**Reprints of "What You Should Know About Wheel Manufacturing" were sent as requested. Reprints of "On the Basic Mechanics of the Grinding Process" should be obtainable through the American Society of Mechanical Engineers, New York, New York.**

### Zirconium Abrasives

Mr. Charles W. F. Jacobs, senior ceramist of this Division, has written an article entitled, "What's the Status of Zirconium Type Abrasives?" which appeared in the September 1959 issue of your magazine. We would like to include this article as the insert for our February 1960 issue of our Daily Reminder Memo Book and request your permission to do so. Naturally, the proper credits to your magazine will be given.

**THE TITANIUM ALLOY**
**MANUFACTURING DIVISION**
**National Lead Company**
**D. S. Pasternak**
**Sales Development Engineer**

**Permission, of course, gladly granted.**

### Exports

We recently received a very interesting report from the American Exporter Publications. We feel the following would be of interest to you.

Foreign metalworking plants will expand their output 80% in the next three years and at least 50% of these plants will fill their equipment needs through purchases from the United States, says INDUSTRIAL WORLD in its current survey of metalworking plants in 46 countries.

Survey results, to be published in the January 1960 issue, indicate Latin America will achieve the biggest output increase by 1963. Some 141 metalworking plants in that area say they expect an output increase of 111%. Plants in the Far East forecast an incease of 104%, with the already-industrialized area of Europe predicting only a 41% gain.

To accomplish this growth, the survey shows—from 423 responses—that the average metalworking plant abroad expects to spend about $193,000 for new capital equipment with half the purchases coming from the U.S.

To achieve this increase output, 73% of the plants report they will need more metalworking equipment, 47% will need more instruments and controls, and 40% report a need for new materials handling equipment. • • •


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# TOOLROOM GRINDERS

## MANY UNUSUAL FEATURES ASSURE HIGH EFFICIENCY

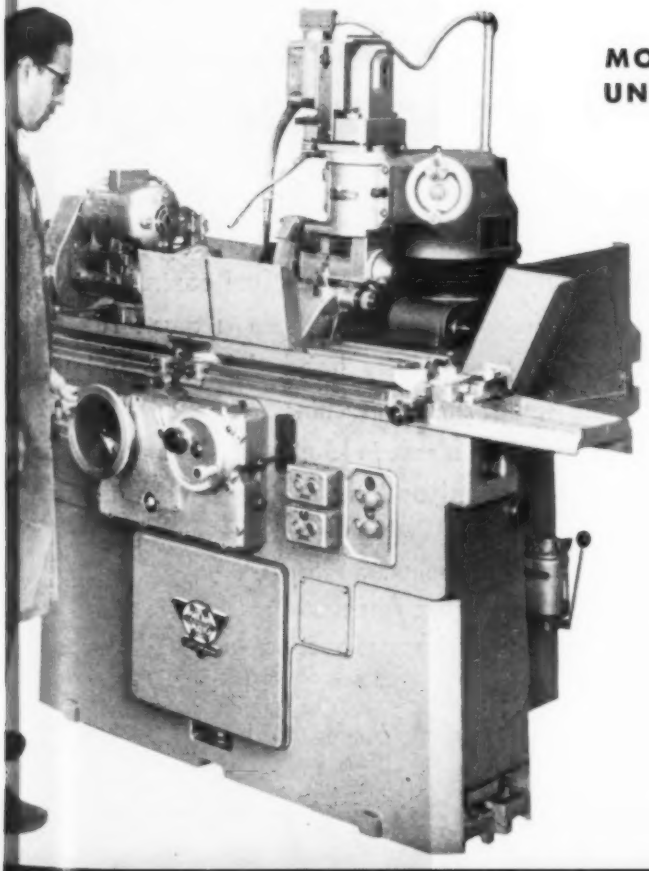
### MODEL 310
### CUTTER AND TOOL GRINDER

This grinder efficiently performs a wide range of grinding operations. Thus, tools and cutters can be ground in shortest possible time to keep production costs at a minimum.

### FEATURES:

Universal operating positions—all within comfortable reach of operator • Anti-friction cross saddle mounting assures sensitive control to cross feed • Table traverses on precision roller chains, giving "fingertip" control • Table dogs reversible—one end spring loaded and the other a dead stop • Table swivels a full 90 degrees in left-hand direction and 45 degrees right-hand • Large diameter wheel spindle, mounted on specially selected preloaded bearings • Universal Cutter Head adjustable to swing from 8" to 12" diameters • Cutter Head and Tailstock provided with clearance angle setting adjustments.

***For additional information, write for Micromatic Bulletin 139W.***



### MODEL 1014
### UNIVERSAL TOOLROOM GRINDER

This 1014 Universal Tool Room Grinder is designed to give extraordinary sensitive control that results in *high quality external and internal grinding.*

Wheelhead has deep throat capacity and wheel position is centralized in relation to table. This permits surface grinding and offers special facilities for broach grinding.

The extra Universal Cutterhead extends the versatility of this highly accurate machine to cover tool and cutter grinding.

### FEATURES:

Hand cross feed and vertical feed in .0001" increments • Auto cross feed per reversal of table of .0001" to .007" over .025" (reduction in work diameter of .050") • Automatic table traverse, 4 speeds provided. Micrometer adjustment to table traverse in .001" divisions • Wheelhead saddle on anti-friction mountings • Precision built wheelhead motor on anti-vibration mountings • Wheel spindle unit swivels full 360° • Five external grinding wheel speeds • Grinding wheels fitted on either end of wheel spindle. Nitralloy spindle runs in plain bearings • Vernier scales to wheelhead and table swivels • Fast cross traverse to wheelhead for setting purposes.

***For additional information, send for Micromatic Bulletin 206Q.***

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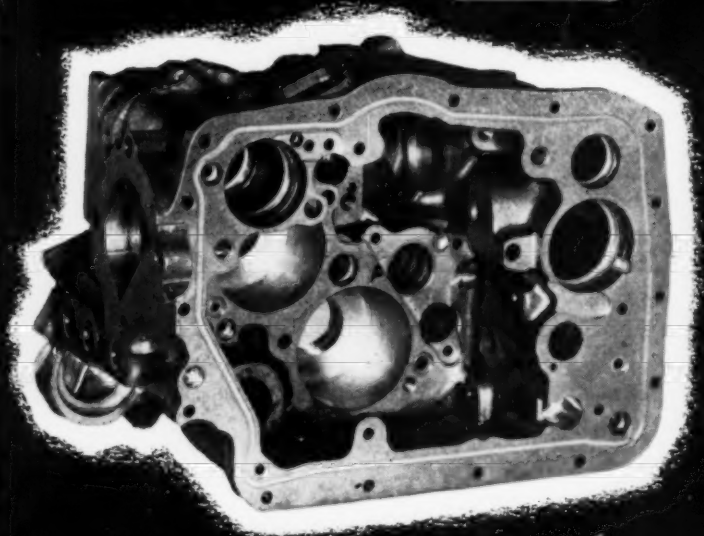

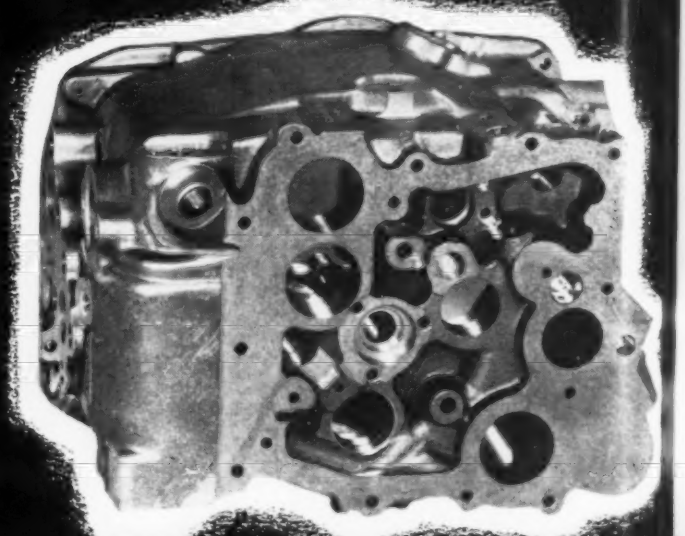

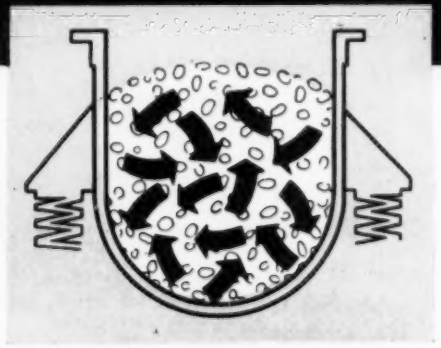

**CONSTANT OVERALL ABRASIVE ACTION**—The Vibratron work zone extends throughout the abrasive mass. Every surface is subject to constant vibrating abrasive action.

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Woodward Governor Co., Rockford, Ill., long a leading manufacturer of all types of governors for prime movers, manufacture such highly precise equipment as jet engine fuel control systems. Precise finish and dimensional tolerances are a must! The fuel control shown above was previously hand deburred and then tumbled in a multiple compartment machine for 1 hour. Now . . . these cases are processed *2 at a time in 15 minutes* in the Vibratron. No hand operation is required and the finish is more uniform.

**IF YOU NEED HELP ON A FINISHING PROBLEM, *Write or Phone today* FOR FULL PARTICULARS. IT WILL PAY YOU TO GET THE FACTS ON VIBRATRON PROCESSING.**

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# Editor's Page

JANUARY 1960

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## ARE YOU READY?

It is 1960 and are you ready for it? The experts and business leaders from all fields have been proclaiming the 60's as having tremendous possibilities for being the most financially successful decade we have ever known. Only labor darkens a truly bright future. This, of course, is the steelworkers primarily.

But, our question is, are you ready? Have you taken time out to look at the forest or are you only looking at the trees? At this time the big picture is most important. If you are not already feeling the increase you soon will be. It will then be too late to take stock and prepare for the increased activity. I'm sure we all know the importance of having the details fall into the over-all pattern, but, have you taken the time to set the stage for the over-all pattern and develop the necessary outline in which the details must fall?

As a contribution to looking at the over-all picture or forest, we would like to remind you of the importance of grinding and finishing operations. In the past when we have asked the question, "Why don't you grind it?" Most of the time we receive one of these two answers: "We have a mill (or whatever machine they are now using) and so we use it" and "This is the way we have always done it." Both of these answers seem to lack in having an over-all approach to the problems.

No manufacturer should handicap himself by a short sighted approach. As part of the over-all picture he should keep in mind that any stock removal operation can be performed by an abrasive operation. Obviously, abrasive operations are not a panacea. Each operation will have an area of superiority, but the point is that the over-all should include the evaluation of each operation in terms of what can be done today by each of the many methods and also what will be possible tomorrow.

To help you in looking at the over-all picture or forest we have again contacted the leaders of our industry. In this issue the article "The State of the Industry" includes remarks from these leaders about both the future developments and business outlook as well as a summary of what has taken place over the past year.

We are sure you will find this type of material beneficial, but, do not overlook that fact that many abrasive operations are not being used to full advantage. Even those operations which we do not consider new in concept are still not used to their greatest advantage. The industry developments are still only on the verge of making their impact on the metalworking field. Are you ready to take advantage of this industry in view of the tremendous '60's?

M. M. Patterson

# Don Chisholm solved a double problem at Split Ballbearing . . .

It all started with a torque tube bearing for one of the top priority missile guidance systems. Two kinds of trouble had developed during the manufacturing process and engineers at the Split Ballbearing Division of Miniature Precision Bearings, Inc., Lebanon, N. H., were in a hurry to get both of them straightened out.

First, in bore-grinding the inner race, about .010″ of stock had to be removed, but the tolerance specified was a microscopic ±.0001 and an eight microinch finish was mandatory. The bore-grinding wheel used wasn't up to requirements and the reject rate was excessive.

Second, in lapping the faces of both races, the wheels used were not producing the required five microinch finish, there was an imbalance between the amount of stock removed from the upper and lower surfaces . . . and, on top of that, the wheels themselves broke down too rapidly.

Bay State was called in and Abrasive Specialist Don Chisholm attacked the problem, working closely with Distributor Harold Domingue, Abrasives & Tools, Inc., Auburn, Mass. They not only cured both troubles and brought production up to the standards required . . . the people at Split Ballbearing were so delighted they asked Chisholm and Domingue to make a survey of every grinding operation in the plant. This led to fourteen other carefully considered recommendations.

Like Hal Domingue and Don Chisholm, the Bay State people in your area are trained specialists. Whether you have a single problem or a multitude of them, they're ready to apply experience, imagination and plain hard work. *Better grinding at lower cost . . . that is their business.*

Skill and experience play a vital part in maintaining the ultra-precise standards demanded by Split Ballbearing customers. Here, the company's senior machine operator, Emory Malloch, loads the fixture plate in the big production lapping machine with torque tube races.

Examining the precisely lapped finish on a pair of bearing races are Frank Orth (left), Chief Industrial Engineer at Split Ballbearing, and George R. Morin, Factory Manager.

# and they gave him 14 more!

Don Chisholm has built a formidable reputation for solving tricky abrasive problems. Prior to joining Bay State as an abrasive specialist, he spent 17 years as Abrasive & Tool Coordinator at General Electric's turbo-super-charger and jet engine plants where his experience was extremely varied since he had to use abrasives on unusual alloys as well as the general run of industrial metals.

# BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
*In Canada:* Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
*Branch Offices:* Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

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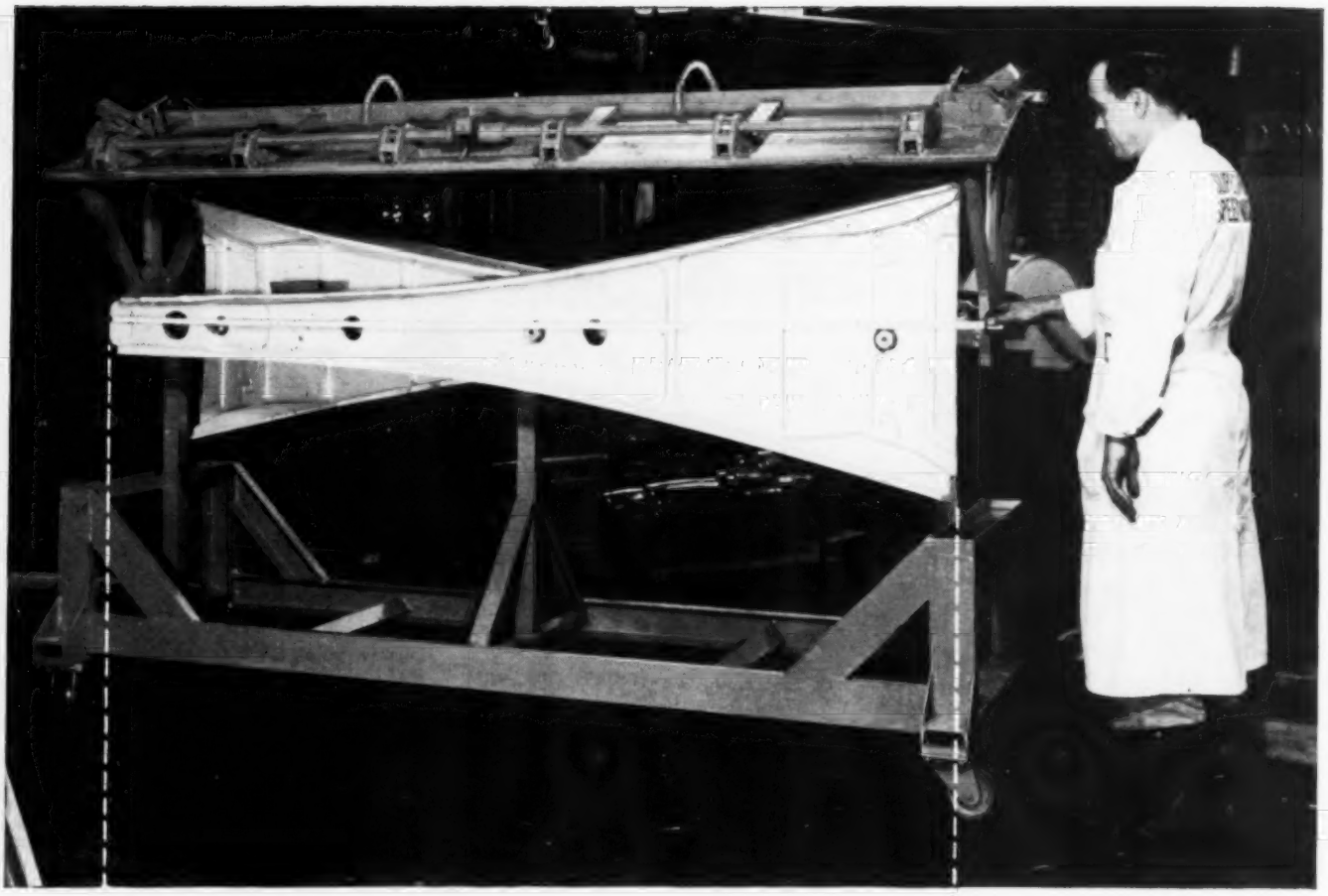


# Can parts this long be barrel finished?

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YES! With ALMCO's efficient, versatile barrel finishing equipment, the 93 inch wing spar above was finished in a two hour time cycle. Thirty inches long at the wide end and 8 inches thick, the spars are finished two at a time in a special ALMCO unit at McDonnell Aircraft Corp., St. Louis, Missouri. Previous hand methods required many additional hours of finishing time and it was difficult to maintain uniformity of the parts.

These aircraft wing spars are barrel finished to blend in radii and improve micro-inch finish on other surfaces through use of ALMCO Supersheen media and burnishing compounds. All surfaces receive the same treatment—rejects due to imperfect finishing are eliminated. Tremendous labor savings are made by using ALMCO's modern barrel finishing methods.

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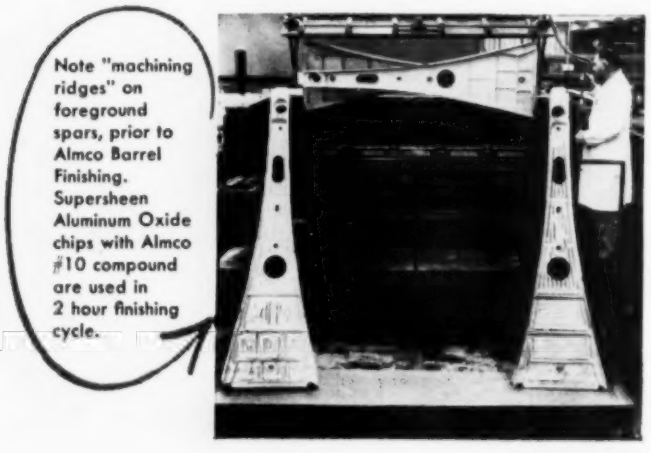

Note "machining ridges" on foreground spars, prior to Almco Barrel Finishing. Supersheen Aluminum Oxide chips with Almco #10 compound are used in 2 hour finishing cycle.

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# Design for Grinding

RICHARD L. McKEE • Associate Editor

## SCORE:

# Surface Grinding--7; Planing--4

● Boosting production from four to seven die blocks per shift and eliminating one change of set-up per die convinced one prominent metal-working company of the advantages of high-powered precision surface grinding over planing. Annual savings in labor costs came to $3640.

The job was to refinish forging dies for drop hammers used to work ingots into blooms, billets or slabs. These forging dies are made of tough nickel-chrome-molybdenum steel.

These were formerly reworked on a planer. While two dies could be machined at once, two changes in setup were necessary to finish the beveled corners. Best production was four blocks per shift. It was often necessary to remove tool marks by grinding.

With the installation of a 100 hp Mattison vertical spindle surface grinder, production has been increased to an average output of seven die blocks per shift. A holding fixture has been fitted to the grinder, so that the beveled edges can be ground easily by tilting the die. This eliminates the changes in setup that formerly had to be made. Any incidental grinding to remove tool marks has, of course, become unnecessary.

Even at that, operators report that the job is sometimes tough enough to tax the 100 hp spindle drive motor. • • •

(Data and photos courtesy Mattison Machine Works, Rockford, Ill.)

**A high-powered precision surface grinder plus a special holding fixture makes its possible to grind this beveled edge forging die of nickel-chrome-molybdenum without a change in setup.**

**Grinding the beveled edge of a forging die for drop hammers used to work ingots into blooms and billets. Elimination of setup changes was key factor in saving about $3640 annually on this job.**

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# Design for Grinding

### Largest Permanent Magnet Works in Atomic Energy

The world's largest permanent magnet is scheduled to work in America's atomic energy program. It will help pump liquid sodium in a breeder reactor to be operated by the Argonne National Laboratory for the Atomic Energy Commission.

The magnet, made by The Arnold Engineering Company of Marengo, Ill., a subsidiary of Allegheny Ludlum Steel Corporation, weighs 1720 pounds, and is made of Alnico V material. The overall dimensions of the magnet are 52½ by 36 by 10 inches. It has a gap length of 16½ inches and a gap volume of 1584 cubic inches.

A workman at The Arnold Engineering Company plant with the world's largest permanent magnet.

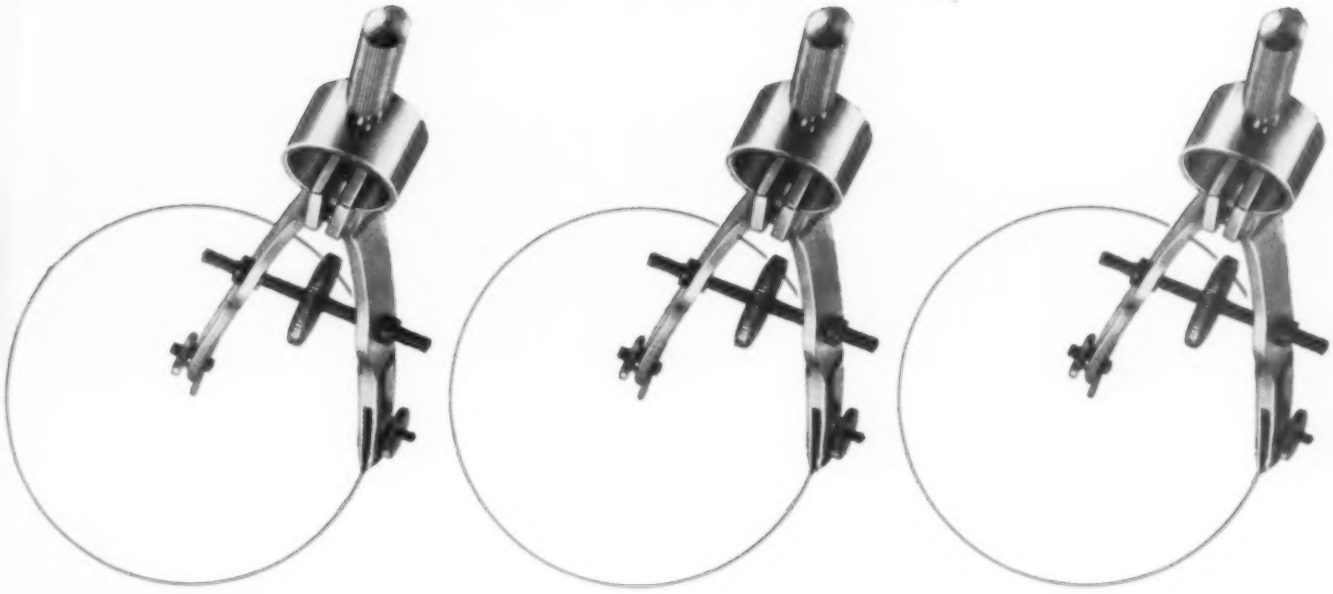
Tests are now being conducted on AM-355 stainless steel for use on special fuel containers for solid fuel rockets. Pictured above is an engineer from The Budd Company of Philadelphia making tests on a model of the container for strains in various sections. The stainless steel, AM-355, used in this model is made by Allegheny Ludlum Steel Corporation.

### British Industrial Display Tops Previous Shows in U.S.

The biggest and most complete display of British industry ever shown in the United States will be part of a 17-day British Exhibition of industry, technology, science and culture in the New York Coliseum June 10-26, 1960.

The Federation of British Industries is sponsoring the event with the backing and support of the British government.

The extensive displays will include the most advanced products and developments in the fields of engineering, iron and steel, electronics, construction and office machinery.



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As surely as a drawing compass can produce identical circles, you can be sure of getting Positive Duplication with these floor stand grinding wheels, and with *all* CINCINNATI (PD) ° SNAGGING WHEELS.

This predictable uniformity is the result of Cincinnati's unique 36-step (PD) manufacturing process. These rigid controls achieve tolerances for wheel inside diameters which are the "tightest" in the industry. Your (PD) WHEELS have better balance and last longer.

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Your cleaning room costs will go down, when you start using CINCINNATI (PD) WHEELS. Our grinding specialists are at your service, to work with you in finding the best grading for your stand, swing frame and portable grinders. Once you have the (PD) WHEELS that give you the lowest labor and wheel cost, you can keep those costs down, because each reorder wheel will act and grind exactly like the original wheel . . . thanks to Positive Duplication.

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For experienced help on cutting costs, call your CINCINNATI (PD) GRINDING WHEELS Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

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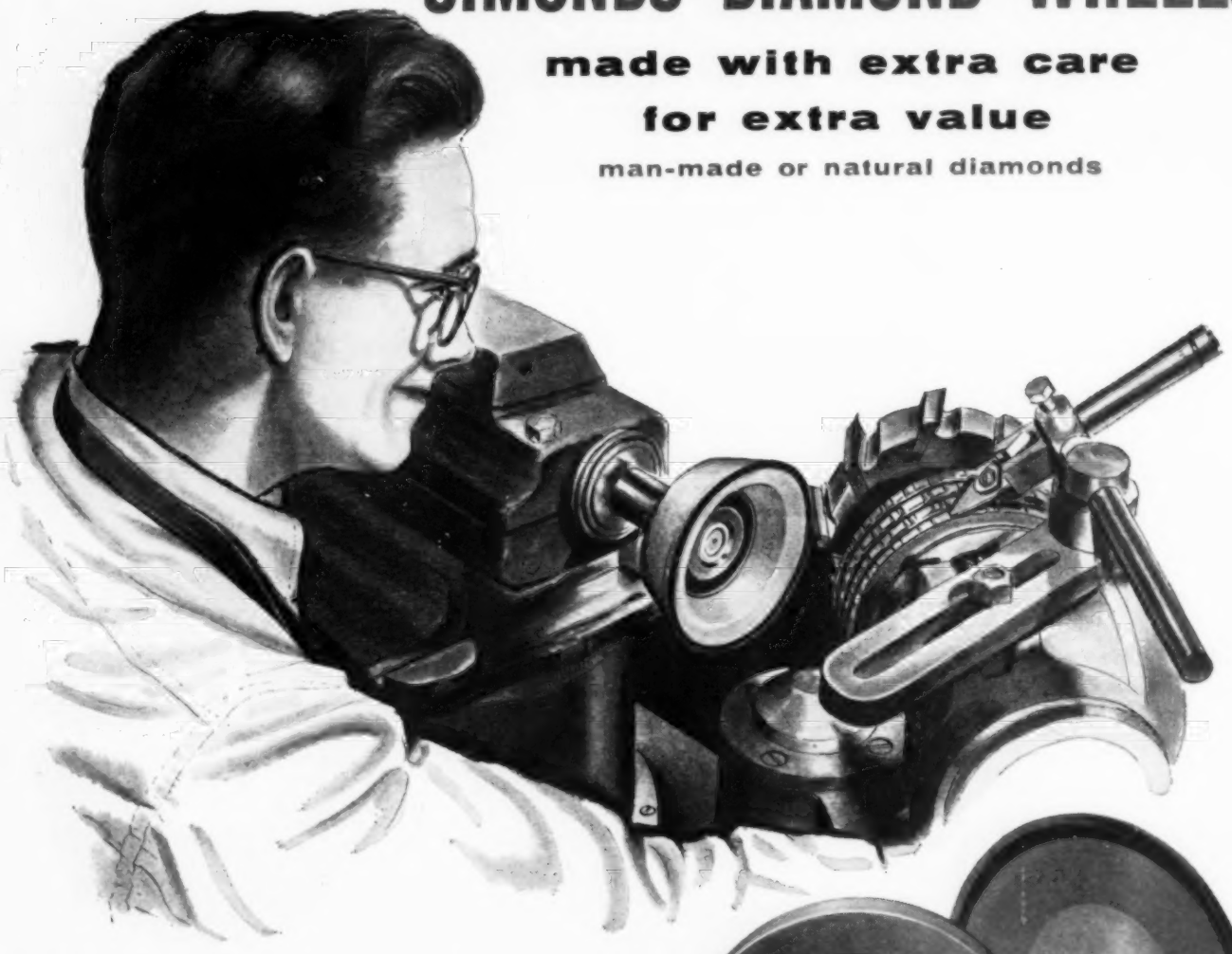

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**Resinoid bonded wheels** are designed specifically for dry abrasive cutting machines. They cut at rates of 3 to 5 seconds per square inch, will cut 2" x 2" hardened steel on a standard chop stroke machine in 16 seconds.

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**Masonry cutting blades,** including reinforced types, are available for both wet and dry cutting of such materials as fire brick, concrete block, glazed tile, and transite. Use of the proper ALLISON wheel can reduce down-time for furnace repairs by speeding the installation of refractory brick.

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# You Asked . . .

ARTHUR RAKESTRAW
Contributing Editor

### Surface Grinding of Steel

**• I would be obliged to you if you would let me know the recommended table speeds, cross feeds, possibly the infeed per pass for both roughing and finishing for horizontal spindle grinders (spindle motor 7 hp) for steel (tool, alloy, stainless, machinery).—T. B., New York, N. Y.**

So many factors are involved in the horizontal surface grinding of the various materials you have enumerated that it would be impossible for me to offer any worthwhile suggestions. The diameter of the wheel and width of face; the abrasive wheel specifications most suitable for the various materials; area and design of the different parts—all these have an important bearing on the rate of infeed, cross feed and table traverse.

For instance, in traverse grinding, as well as in cylindrical, the first edge of the abrasive wheel face wears at a faster rate because of the increased contact pressure and heavier stock removal. It is desirable to feed the wheel at a rate which will provide a uniform wheel contact across the entire width of the work piece, or otherwise the wheel face would be tapered. The amount of infeed depends almost entirely on the abrasive wheel specification.

We have no knowledge of available information regarding maximum infeed and cross feed for processing the materials you have mentioned. It would be our suggestion that after obtaining the best possible wheel specifications for the various materials, that by trial and error you develop the optimum operating conditions that the abrasive wheels will economically provide.

The manufacturer of your particular grinding machine, abrasive wheel manufacturers, or a book such as THE GRINDING WHEEL can provide you with basic recommendations.

### Centerless Grinding M-50 Tool Steel

**• What would be your recommendation for grinding M-50 tool steel, which is now being used in the bearing industry on ⅛" diameter rollers, ¾" diameter inner races and 1" diameter outer races, on a centerless grinder. For your convenience, the analysis of M-50 is: carbon—.80; silicon—.25; manganese—.30; chrome—4.10; vanadium—1.10; and molybdenum—4.25. Hardness is Rc 63-65.—J. Q., Pittsburgh, Pa.**

"Polishing a diamond. Why."

Materials such as M-50 tool steel fall into the category normally recognized as difficult to grind, and would be as difficult to grind, and would be classed among those types having a very low grindability index.

Because of its resistance to abrasion, some reduction in the rate of production could naturally be expected.

The bearing parts designated above cover a rather wide range of diameters, much too wide to be processed by a single abrasive wheel specification. Because of the comparatively small diameter of the rolls (⅛") and the relatively small arc of contact, the recommendation for the roughing cuts would be a specification in 80 grit, a semi-friable abrasive type, grade 0, vitrified bond.

For the ¾" diameter inner and the 1" outer races, it might be necessary to utilize a specification one or two grades softer.

Very satisfactory finishes can be produced by such a wheel specification. However, if finer finishes than result from this specification are required, particularly for the rollers, it is suggested that a silicon carbide abrasive

**You Asked . . .** has become a very popular page in GRINDING and FINISHING since it was established over a year ago. The questions have covered everything from detailed operating problems to rather broad basic ideas. Replies have been equally varied.

You can use either the READER SERVICE CARD or a separate letter to submit your problem or question. We'll get it answered as soon as possible and send you a reply, in addition to the published answer.

**—The Editors**

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# You Asked . .

wheel in 320 grit size, grade N, shellac bond be tried.

Many of the bearing manufacturers also make use of fine grit rubber bonded wheels for the usual run of ball races.

### Flaring Cup vs. Depressed Center Wheels

**For portable grinders grinding either clean-up or weld seams, in your opinion is it cheaper to use Type 11 flaring cup wheels or to use the new Type 27 depressed center wheels?—A. P., Youngstown, Ohio.**

It would be difficult to state categorically that either the Type 11 flaring cup or the depressed center type wheel is most economical for the applications to which you refer. Certainly such a comparison would of necessity be limited to specific applications and could not be accepted as a law governing all weld grinding.

From the standpoint of abrasive cost per usable volume of abrasive, it is my opinion that the Type 11 cup wheel is most economical. On heavy welded beads, where considerable wheel pressure is necessary, the Type 11 cup would, of course, be favored. However, because of the flexibility of the Type 27 depressed center wheel, improved finishes and blended surfaces can be secured.

Many operators prefer the lighter weight Type 27 wheel because of its ease of handling. In many instances, also, the more rapid rate of cut more than offsets the comparative higher wheel cost and results in an overall reduction in operational cost. • • •

"Two grinders . . . To go"

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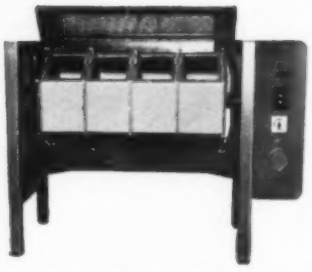

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# American Society for Abrasives

### Hudson-Mohawk Chapter

**George H. Lovegrove**, senior buyer at Marshall-Eclipse Division of the Bendix Aviation Corp. in Green Island, N.Y., was recently elected president of the Hudson-Mohawk Chapter of the American Society for Abrasives at a meeting of the group held at the Crossroads Restaurant in Latham.

**John Stangeby** of Behr-Manning Co., Troy, was named vice-president; **Robert H. Wilcox** of the Watervliet Arsenal, secretary; and **Otto A. Gunther** also of the Arsenal, treasurer. **George K. Shako** of Shako, Inc., Latham and **Al MacBrien** of Federal Bearings, Poughkeepsie, were elected to the board of governors.

**Newly elected officers of the Hudson-Mohawk Chapter of the American Society for Abrasives are shown discussing winter activities. Talking over unit plans are, from left, Robert H. Wilcox, secretary; George H. Lovegrove, president; John Stangeby, vice-president; and Otto A. Gunther, treasurer.**

### Pittsburgh Chapter

"Abrasive Cutting in Today's Industry" was the subject on which **Curtis D. Cummings** spoke to the chapter at their meeting November 19 at the Pittsburgh Athletic Club.

The speaker, sales manager for Allison-Campbell Division, American Chain and Cable Company, built his remarks around a 30-minute film, providing background information before and citing specific examples after the showing.

In his remarks, he emphasized the continuing and growing trend toward use of materials that are harder to condition and cut. He also pointed out the advantages of abrasive cutting for the so-called romance metals.

### Long Island Chapter

The holiday party of the chapter, combined with the annual meeting for the election of officers for 1960, was held Wednesday, December 9, at the Wheatley Hills Tavern, Westbury.

The January meeting, Wednesday the 13th, will feature the installation of officers and a repeat performance on "Man-Made Diamonds."

### Detroit Chapter

The December meeting of the Detroit Chapter, a party featuring dinner and the installation of officers for 1960, brought a crowd of 325 people to the Piedmontese Club on December 3rd.

**Leland Pruett,** national chairman of ASA, was chairman of the meeting, and **Dennis Hurley** was in charge of the dinner.

**John H. Gills** of Carborundum heads the chapter as the 1960 president. First vice president is **E. Sorensen** of Detroit Transmission; second vice president, **Dennis Hurley**, Brown Star Products; third vice president, **R. W. Hall**, Chrysler Trenton; treasurer, **R. E. Englund,** Waltham Grinding Wheel.

National delegates are **Cal Edwards**, Ford Motor; **F. Schlie**, Detroit Transmission and **Emil Vogeley**, Cincinnati Milling Machine Co.

During the meeting, tribute was paid to Emil Vogeley, past president, for the progress which the chapter has made in 1959 under his leadership.

### Chicago Chapter

**Donald J. Wallace**, vice president of manufacturing, Wheel Trueing Company, Detroit, spoke to some 35 members and guests of the Chicago chapter at their meeting held at Nielsen's

## AMERICAN SOCIETY FOR ABRASIVES

*(continued)*

Restaurant, Thursday, Oct. 12. His subject was, "Industrial Diamonds and Diamond Tools."

**James Slanaker,** field engineer with Wheel Trueing, also discussed the subject. A discussion period followed the talks.

Slides and a display of diamond tools supplemented the presentation.

It was reported that the chapter now has 66 members, and is aiming for 100 in its first year of operation.

There was no December meeting. The speaker at the January get-together, on Thursday, the fourteenth, will be Gilbert R. Blake, product safety engineer, who is directly concerned with the promotion of grinding wheel safety.

Gilbert R. Blake

Blake, a 20-year man with Norton, and his associates approve new or unusual grinding wheel applications, determine maximum safe operating speeds, suggest improvements in wheel manufacture, investigate reasons for failure of wheel in operation, and carry on a program of education in the proper use of wheels.

The following meeting, February 11, will bring a talk by a representative of the Cincinnati Milling Machine Co.

Regular meetings of the chapter are held on the second Thursday of each month, at Nielsen's Restaurant, 7330 North Avenue.

### New Jersey Chapter

**E. F. Hennis,** district manager, Bryant Chucking Grinder Company, explored various internal grinding problems in his address at the October 21st meeting. A film on the subject and a question-and-answer session rounded out the informative program.

### Connecticut Chapter

Speaker at the October 26 meeting was **Ray Leliaret,** application research engineer of Wheelabrator Corporation, Mishawaka, Indiana, on the subject, "Selecting Blast Cleaning and Peening Abrasives."

Noted from the talk: "Present-day blast cleaning may use either air pressure or centrifugal forces, pellets from .0035" to .093" and velocities from 3,000 to 17,000 fpm. Parts to be cleaned may range from watch springs to 120-ton castings. Materials used might be soft like nutshells or hard like steel grit. The company manufactures approximately 25 billion pellets per day."

### Hudson-Mohawk Chapter

A 16mm color sound film entitled "Steel Shot," which reviews the physical properties of the various ferrous abrasive materials, enlightened the October meeting of the Hudson-Mohawk Chapter. The speaker of the evening, **D. A. Swardson,** abrasive specialist with Wheelabrator Corporation, Mishawaka, Indiana, discussed the proper abrasives for shot-blasting, selection of abrasives and the establishment of comparative cost records.

• • •

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1 Single locking screw—fast action v-block adjustment holds it in desired position.

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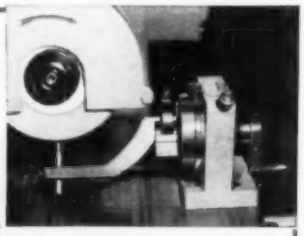
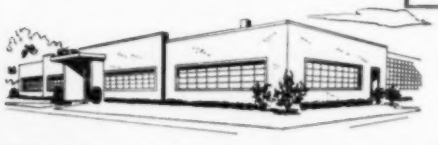


ATTACHMENT QUICKLY CONVERTS HARIG GRIND-ALL FIXTURE INTO A PRECISION RADIUS DRESSER



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- 8,500 R.P.M.
- SMOOTHER —less vibration
- QUIETER —reduces strain from noise
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Save job-time and step up finishing quality with this all-new super-fast ARO Sander! Cut costs! Sands right up to edges. Combines workhorse stamina with precision craftsmanship for long life, minimum upkeep. Ask your Aro Distributor for a free demonstration.

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# EXOLON ABRASIVES + Rotomatic Finishing = BETTER FINISHES FASTER AND AT LOWER COSTS

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ROTOMATIC Finishing Machine
manufactured by Roto-Finish Co.

Deburred without changing surface finish in 1 minute with No. 14 abrasive, 480 per hour.

Machining burrs removed in 4 minutes, with No. 4 abrasive, 240 per hour.

Burrs removed with No. 4 abrasive in 4 minutes, 240 per hour.

## A Modern Abrasive must team with Modern Equipment to meet the demands of Modern Metal Finishing

One, two, four, eight and sixteen spindle machines are now available in the Rotomatic series. After a part is attached to a spindle, it is rotated in Exolon abrasives, usually in the #4 to #14 size range, which have been conditioned by special compounds to form an abrasive slurry. The spindle indexes through the abrasive slurry returning to the operator's station.

EXOLON abrasives are produced from solid fused aluminum oxide made under carefully controlled conditions in electric arc furnaces. This hard, tough abrasive is carefully shaped and sized and provides speedy uniform finishing results.

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*Manufacturers of* SILICON CARBIDE *and* ALUMINUM OXIDE ABRASIVES

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# Ideas from the Shop

### Old Steel Rules Renewed By Grinding Edges

By H. J. Gerber

• The six inch steel rule, so often carried in the machinist's shirt pocket and probably his most frequently used measuring tool, is often discarded prematurely because of a fault which is easily corrected. These rules take a considerable amount of abuse along the edges and particularly the four corners become rounded so that the rule is no longer reliable for accurate end measurements.

Quite a few of these rules can be salvaged by the simple illustrated method. The rule is carefully set up in a small toolmaker's vise on the magnetic chuck of a surface grinder. The edge of the rule must be located parallel to the surface of the chuck. A few passes of the rule under the wheel will renew the worn edge and remove the worn radius on the corners. Graduations which have been obliterated along the edge will once again be sharp and clearly defined. Aside from a slight and inconsequential shortening of the length of the graduation marks, the rule suffers no harm and its accuracy is again comparable to a new one.

Set-up for salvaging a steel rule.

Carbide machine reamer mounted in a lathe for a lapping operation to remove roughness. The lap is a split bronze bushing of appropriate size.

### LAP FOR RECONDITIONING CARBIDE REAMERS

By H. J. Gerber

• A bronze bushing, bored to correct size and split diagonally to provide a snug spring fit, makes a good lap for removing roughness and buildup from the peripheral edges of the flutes of a carbide reamer.

The reamer is mounted in a lathe for the lapping operation. While the lathe spindle is revolved in reverse at a fairly high speed, the operator slides the lap back and forward along the fluted portion of the reamer.

The cutting medium used is a commercial diamond lapping compound.

If it should be desired to tighten the lap further on the reamer, this can easily be done by clamping a lathe dog on the lap. The dog also serves as a handle when the work is rotating.

WE ARE ACTUAL MANUFACTURERS of EVERY BOND TYPE and SIZE DIAMOND WHEEL...

...we do not simply select a "suitable" size and shape per given bond — we manufacture all three bonds in all sizes as evidenced by our catalog #159. Write for it today.

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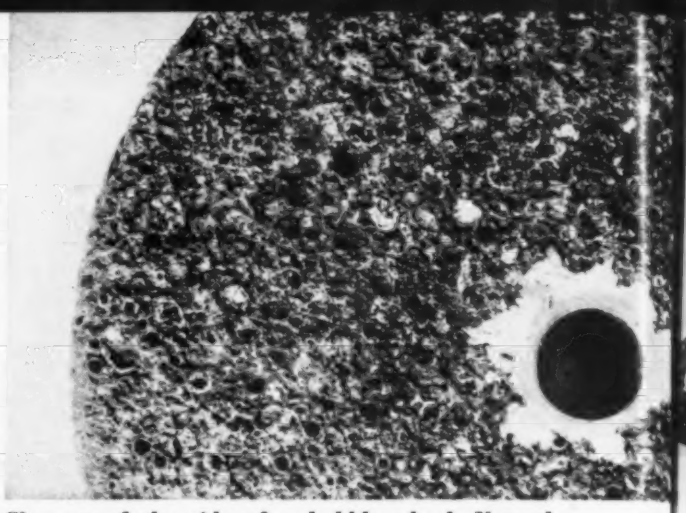

Close-up of the side of a bubble wheel. Note the relative size of the pores caused by the fracturing of the abrasive particles in the finishing operation.

# "Bubble" Wheels fo Soft Non-Metallics

**New abrasive wheel, using alumina bubbles wit resinoid bond, is easily formed, operates a 9,500 sfpm, grinds rubber, leather, cork effi ciently and without loading.**

By DONALD G. FOOT
Bonded Abrasives Division
The Carborundum Company

● Conventional abrasive wheels have had few applications in soft non-metallics—cork, fiber, wood, rubber—because of built-in limitations. Pressure between wheel and work-piece has proved to be insufficient to provide normal grinding action. The grain particles become dull and glazed, but do not fracture to provide fresh cutting points. Because the chips are large, the wheel face quickly becomes loaded.

With these handicaps, the only apparent solution has been to use a very soft wheel, with weak bond "posts," so that whole grains could be torn from the wheel face, and to operate the wheel at a slow speed. This is costly in terms of abrasive and inefficient in grinding action. Best results in grinding soft materials are obtained by operating the wheels at their maximum safe speed.

These limitations have been largely overcome by the development of abrasive particles of a radically different type, spheres or "bubbles" of fused aluminum oxide. A similar material has for several years been used as high-temperature insulation for electric furnaces, in much the same manner as loose fill is used for house insulation.

As spheres, the particles are sufficiently strong to permit molding, but in use they fracture under minimum pressure. The bond does not penetrate or fill the bubbles. Fractured walls of the spheres provide a multitude of sharp cutting edges, while the smooth interior gives ample space for chip

**Bubble wheels can be molded in a variety of standard shapes. Shown above are a straight wheel, four cylinder wheels, a flaring cup, a plug, mounted wheels.**

clearance. There is little or no tendency to retain the chip and load the wheel face.

Abrasive bubbles, in resin bond, produce a low-weight, strong wheel with reinforced ceramic knife edges at the cutting face. Wheels so bonded may be operated safely at speeds up to 9,500 sfpm.

Materials which have been ground with bubble wheels, and the results, are shown below:

Rubber: in the range of 5 to 90 durometer ground to close tolerances with excellent finish.

Plastics: including thermoplastics and reinforced laminates, molding flash removed and the material form ground. Heat-sensitive and low tensile materials such as styrene foam ground to dimensions without deformation.

Cork: including bonded granular cork slabs, readily formed and surfaced.

Ceramic bisque: form ground, permitting less elaborate molds.

Wood: stock removed rapidly and efficiently with no burn and a smooth finish.

Brake lining: including preformed shapes, ground to excellent finish and close dimensions.

Fiber board: ground and skived.

Along with these advantages, bubble wheels can be shaped to almost any contour. A wheel dresser, an abrasive stick or a diamond, together with a little dexterity, is all that is required.

The ability of these wheels to take increased work speeds and crossfeeds, with deeper cuts, has doubled production in the grinding of rubber rolls, without sacrificing finish. Large rubber gaskets have been ground in one-tenth of the time previously required. A 400% increase in production in the grinding of glass-fiber reinforced plastic dies has been attained.

Results obtained so far indicate that fused aluminum oxide bubble wheels, resinoid-bonded, may well find an expanding area of applications in grinding soft, pressure-deformable and heat-sensitive materials. • • •


WE ARE MANUFACTURERS of RESINOID and RUBBER BONDED GRINDING and POLISHING WHEELS...

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★ reinforced rubber grinding wheels for high speed operation

★ combination grinding and polishing wheels for the cutlery industry

★ grinding and finishing wheels for the aircraft industry

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## Grinding non-ferrous materials to fine tolerances!

This leading manufacturer of electronic systems uses new hard ceramics as microwave system components. These extremely tough materials presented a difficult grinding problem. It was solved by using diamond abrasive wheels on Blanchard No. 11 grinders. The results were outstanding: Disks measuring approximately 2¼" x ¼" were ground to a tolerance of ±.001", with ⅛" of material removed. Flatness is .002", parallelism .002". These parts are ground at the rate of 48 per hour, and surface finish is consistently excellent.

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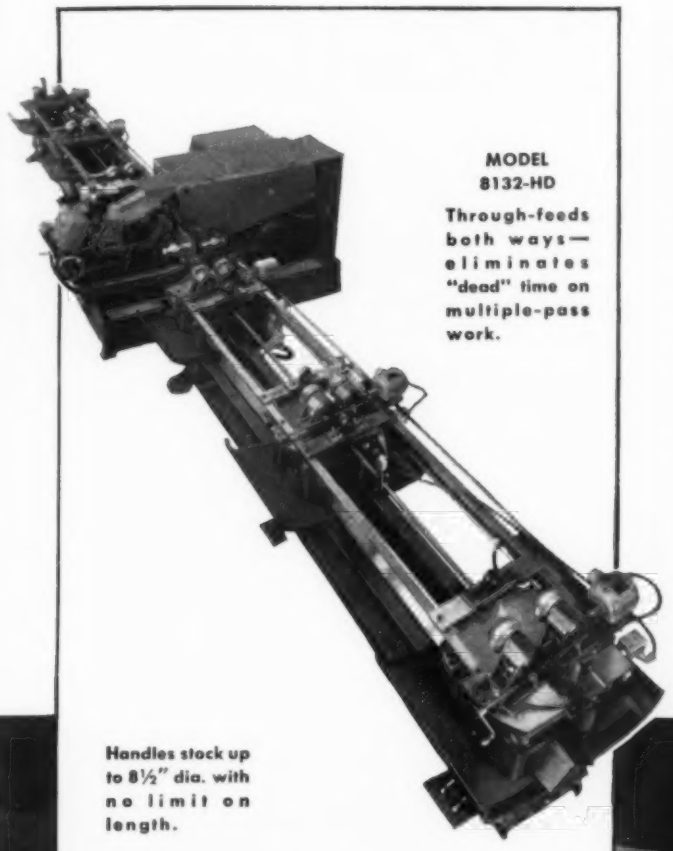
# New centerless belt grinder removes up to 3 lb metal per minute!



**MODEL 8132-HD**

**Through-feeds both ways—eliminates "dead" time on multiple-pass work.**

**Handles stock up to 8½" dia. with no limit on length.**

**. . . sets completely new production rates on heavy-duty precision rod and tube grinding**

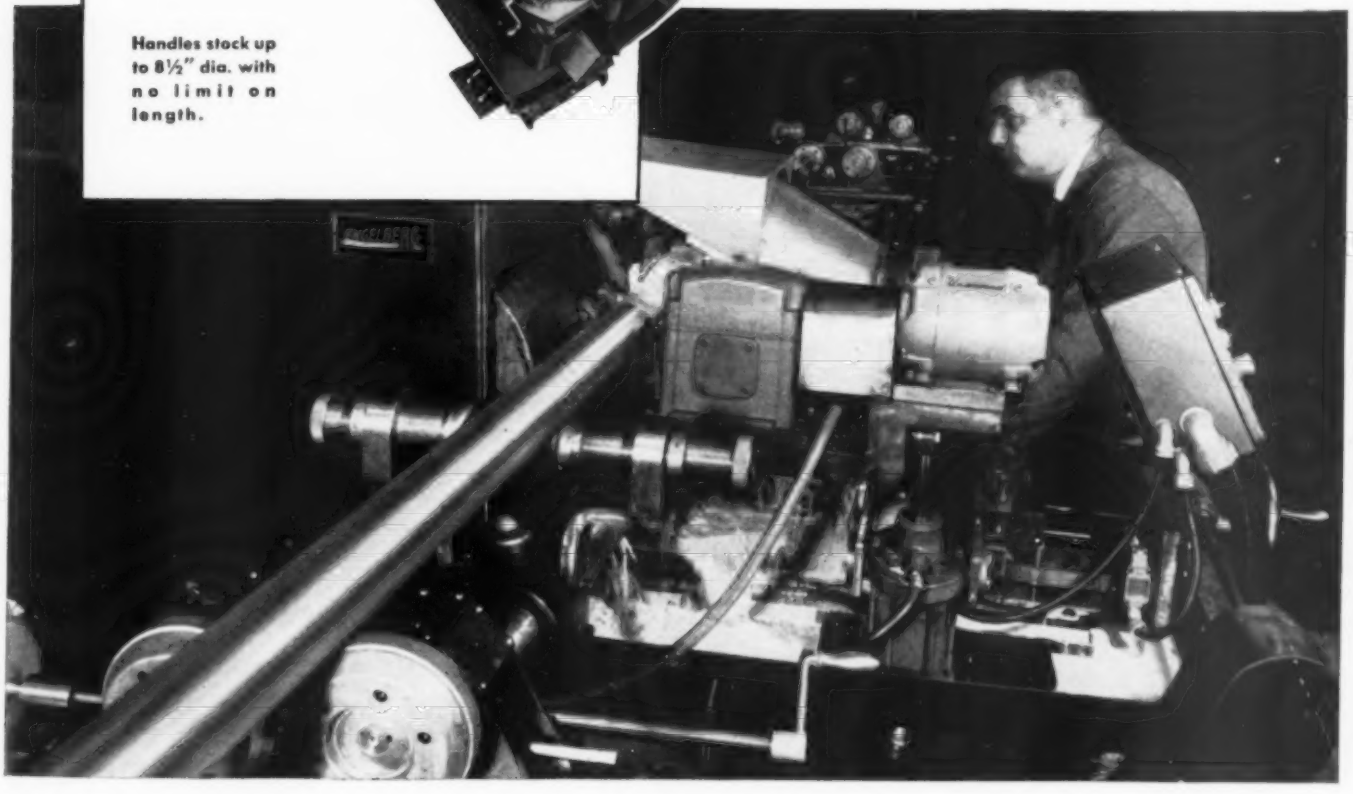
You can do far more work per day with this new Sundstrand-Engelberg precision centerless belt grinder than with any other machine of comparable capacity.

*For example, one user is taking .020" stock removal per pass on 8" dia. steel tubes at a through-feed rate of 7 ft/min!*

The Model 8132-HD illustrated handles stock from 3/32" to 8½" dia. at through-feed rates from 1′ to 40′ per minute — produces to extreme finish and tolerance requirements. And, it grinds with the stock through-feeding in either direction, thus completely eliminating nonproductive time on multiple-pass work.

A powered outboard support system is provided to meet your stock-length requirements. The main power unit controls synchronized outboard slave drive units.

Great versatility . . . large work capacity . . . extreme accuracy . . . and exceptional productivity here are combined into a machine that is *Sundstrand-built* to highest machine tool standards. Other Sundstrand-Engelberg models available for smaller work and with multiple heads for single-pass rough and finish grinding. Literature on request.



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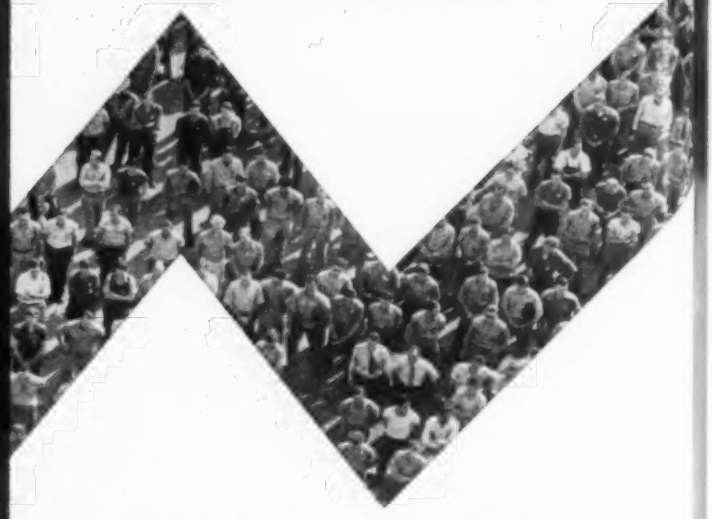
# EXCLUSIVE: LEADERS PREDICT:



## The State of the Industry

● Again this year we have contacted the leaders in our industry in order to bring you the over-all outlook of the grinding and finishing industry. We again asked the questions about what the leaders felt was outstanding in 1959, what the sales picture looks like for 1960, and what they felt we should look for in the way of developments for 1960.

By sneaking a look at last year's report and comparing it with this year's we have found that the leaders last year were not just crystal ball gazing but are actually counting many of their predictions of last year as outstanding developments for 1959. Last year 1959 was predicted as being a year in which operations would reach greater precision, higher speeds and have greater safety. Also mentioned were new applications, products and materials. Almost all these predictions were indicated as outstanding developments for 1959 in this year's report, however, as Paul Brown, president, Peninsular Grinding Wheel Division, stated, "Significant developments do not happen this frequently, although the history of grinding would certainly show continued and

Paul B. Brown

John Jeppson

definite progress in technical developments, contributing to greater efficiencies in our customers' plants. Some of the things, mentioned in my 1958 comments, are certainly coming to pass, even if slowly."

Our second question concerned the sales outlook for 1960 as compared with 1959. The general opinion is to say the least optimistic. The average increase of all those reporting is 22%. This figure is 2% higher than last year and we might add did not include as many companies who felt their business would increase over 50%. There were two subjects of caution which were included in the reports on this question. One mostly from the abrasive manufacturers concerned the pending steel situation. The other mainly from machine builders concerned the delay in buying of equipment until after the Machine Tool Exposition later in the year.

Our third question on predictions in 1960 seems to have been answered in much the same pattern as our first two questions. No single development has dominated the 1960 predictions, however, many refinements appear to be in the works and there will be outstanding developments in specific areas Again the Machine Tool Exposition seems to hold the secrets for 1960.

## 1959—PRECISION AND AUTOMATION

Looking back over the past year we find that there were many more specific developments than the Man-Made diamond story of 1958. But, the Man-Made diamond impact was still with us this last year. The following comments were made: John Jeppson, vice president, Abrasive Division, Norton Company, "Man-Made diamonds continued to be the outstanding development in abrasives during the past year. Great advances have been made in making grinding wheels with them. Equally great advances have been made in the effective use of man-made diamond wheels in customer plants.

"The increased production of man-made diamonds with accompanying price reductions have put wheels made with both natural and man-made diamonds on an equal price footing. This has made practical the use of each type of wheel where it can be used most advantageously.

"At the present time, we feel there is a place in industry for both natural and man-made diamonds. Continued research into the best use of each will benefit all users of diamond wheels."

### Precision

The undisputed advantage of abrasive operations is precision, and as in the year's past the the industry has not simply accepted this advantage but has continued to develop greater precision as the need was indicated. Wallace B. Bainton, vice president, Brown & Sharpe Manufacturing Co., "I believe the most significant development in grinding and finishing applications in 1959 has been the refinement of grinding equipment to obtain ultra finishes and to 'bug's eyebrow' tolerances. Also, simplification of these machines to obtain these finishes and limits with comparatively unskilled operators."

Jack Wiziarde, Diamond Products Sales Mgr., Elgin National Watch Co., ". . . we are impressed by the closer tolerances and critical finishes being specified. Normal lapping and finishing techniques, as we used to know them, are now being altered and refined to produce the custom finishes now required. It is truly a challenge to meet the exacting requirements and one cannot stay long with the old 'tried and true' methods."

L. R. Rothenberger, vice president, The DoAll Company, ". . . introduction of a hand operated grinder that removes metal to 'tenth' accuracy from hand wheel settings . . . has eliminated the 'cut and measure' practice that has been typical of hand grinding for years."

Robert D. Lawson, vice president and sales manager Machine Tool Div., Norton Company, "While there have been no revolutionary developments in grinding or finishing during the past year, there seems to be a continued emphasis on closer and finer finishes. Greater productivity is also a requirement of the machine tool builder."

### Automation-Production

Automation of equipment or process is a continuing development. Surprisingly a number of processes have not yet reached their ultimate in speed of production. A number of the leaders felt this area to be outstanding for 1959.

Leon A. Pratt, vice president, Carborundum Company, stated, "The refinement of the crushed dressing technique makes possible automatic production grinding from the solid far superior, in both precision and cost, to the conventional multi-step methods. This opens a new field for grinding wheels and for the first time, makes grinding competitive with screw machining."

M. T. Hunt

W. B. Bainton

L. R. Rothenberger

Robert D. Lawson

# The State of the Industry 1959-1960

Alan C. Mattison, president, Mattison Machine Works, reported, "The most significant trends we can see are in the fields of abrasive-belt grinding and automation. It has been proved that honeycomb, tough super alloys, and difficult-to-machine non-metallic materials can be ground economically with coated abrasives.

Carl Shonhoft, manager of grinding machines sales, Cincinnati Milling Machine Co., "New grinding machines which reduce the cost of manufactured parts are surely among the most significant developments of the year. Among these machines, based on the triad of shorter grinding cycle time, improved finish and closer limits of accuracy, are a 4" precision grinding machine which will grind to within a few millionths of an inch —on a semi-automatic production basis; and a completely new line of centerless grinding machines."

Roman Zech, secretary, Murray-Way Corporation, stated, "There has been an intense interest on the part of the small supplier of finishing to mechanize and automate—influenced, no doubt, by such factors as: utilizing new materials, providing more safety, meeting quality specifications of the user, and establishing a program of staying in business at a profit."

**Machines**

Last year seems to have been a year of refinements so far as machines are concerned. Two notable exceptions have been the vibratory type finishing equipment (July and November 1959 Grinding and Finishing) and new super finishing equipment (August 1959 Grinding and Finishing).

James S. Tomlinson, President, General Abrasive Company, remarked, "In the finishing field, one important development has been the introduction of the so-called 'vibrator' as a supplement to other methods of barrel finishing. This development has increased the demand for tough aluminum oxide abrasives."

G. W. Balz, president, Roto-Finish Co., stated. "I feel that the most significant development in our industry during 1959 has been the development of a simple, low cost, mechanically reliable vibrator type machine for general deburring and finishing."

The super finishing development is described by Frederick S. Blackall, president & treasurer, Taft-Pierce Mfg. Co., who commented, "With pardonable pride, as American licensees, we feel that one of the most significant developments in the finishing applications during 1959 has been the advent of the German Supfina process of microstoning."

Ernest E. Olds, vice president, Size Control Co., remarked, "The most significant developments in the field of grinding and finishing in 1959 are, in our opinion, the new electrolytic processes."

Price seems to have been an important point in 1959 as evidenced by the following. R. F. Pendergast, president, Timesavers Sanders, "The most significant development we have affected is the production of a very low-cost machine to sand, polish and deburr most types of metals. These low-cost machines have found a very wide market."

H. P. Bailey, president, Rotor Tool Company, "One of the significant developments of the year has been reduction in the weight and size of portable tools using cup wheels, sanding pads and wire brushes. This is due, of course, to improvement in air motors which constantly develop a little more horsepower."

Specialized equipment has been developed as indicated by Don S. Connor, president, Micromatic Hone Corp., statement, "The introduction of equipment using the 'centerless' principle for Microhoning ball tracks in the inner and outer rings for anti-friction bearings. This development not only simplified the handling of parts, but also improved the accuracy that is generated."

F. S. Blackall, Jr.

Don S. Connor

This area is best summed up to by A. C. Reppenhagen's, president and general manager, Mid-West Abrasive Company, remarks, "It appears to me that our industries' continued effort to improve upon mechanical features of the grinding and finishing equipment is the greatest contribution possible to those that this industry serves."

**Applications and New Products**

This is the largest area of our report for 1959 and it is rather pleasing that this situation should occur. It shows that there has been a definite movement of abrasive operations into new fields and expansion into areas in which they were not as strong.

Elden L. Auker, vice president, Bay State Abrasive Products Co., exemplifies our statement in his remarks, "In my opinion, the most significant developments in grinding and finishing applications in 1959 were the technological developments in new machines to allow grinding wheels to be used safely at greater surface feet per minute. Progressive thinking Process Engineers are taking up the slogan of 'grind it—don't turn it for equal stock removal, greater accuracy and better finishes'."

R. H. Huntington, vice president, Precision Grinding Wheel Co., "The need for progress has been emphasized by technical competition from other industries, as well as by commercial competition within our own industry. Bonded abrasives have replaced diamond wheels in highway sawing applications, reinforced cut-off wheels in foundries have supplanted flame cutting. Alertness in promoting new developments and reducing costs is today's watchword."

W. S. Hoskin, general sales manager, Michigan Abrasives Company, covered the same thoughts about coated abrasives by saying, "One of the most significant developments in 1959, as far as we here are concerned, was the publication of the textbook 'Coated Abrasives.' It was published in 1958 but made available to the public in 1959 and is a 'comprehensive and authorative guide to the miriad of application of Coated Abrasives in industry.' Quoting from its introduction—(Years ago a saying 'You might better use sandpaper' was current when a job of machining, grinding or finishing proved slow or unproductive. Then it was a derisive remark: Nowadays it is excellent advice.)"

J. C. Wilson, vice president, Thompson Grinder Company, picked still another area when he remarked, "We personally feel that the most significant development in the grinding and finishing applications during 1959 is the vast amount of work that has been carried on in the way of speeds and feeds in grinding super alloys or exotic materials as this has undoubtedly been the greatest demand for development work."

James L. Hensley, vice president, Ty-Sa-Man Machine Co., also agreed about this area saying, "The most significant development in our phase of the industry in 1959 was the increased demand, development, and use of abrasive wheels and abrasive saws for processing alloy steels in all forms and sizes."

W. A. Ferguson, president, Standard Electrical Tool Co., "The most significant developments for grinding and finishing applications during 1959 was the requirement from our customers for special machines or the conversion of existing machine tools in their plants."

Coated abrasives received quite a bit of comment last year and continue to develop at a rapid rate. New areas of application and greater stock removal are the two points most often mentioned.

An example is J. F. Claydon's, vice president, Carborundum Co., statement, "Abrasive belt machining via wide belt applications has had a significant development and impact throughout many segments of industry in 1959. Stock removal problems, particularly in the airframe industry, have been solved by this approach thus affording reasonable economics to many of the more advanced manufacturing designs and techniques that this industry is using."

Dirck Olton, manager of Product Engineering at Behr-Manning Co., asserts: "We have seen major developments during 1959 in five key areas: One, increasing use of wide-belt abrasive machines for the corrective grinding and prefinishing of metals prior to forming operations. Two, growing application of belt machines to cylindrical grinding operations—these machines being mounted on the cross-carriage of engine lathes as well as on the wheel slides of conventional grinders. Three, the increased use of abrasive belt machines in surface grinding. Today it is possible to purchase abrasive belt surface grinders in widths from 3 to 86 in. Four, the advent of abrasive belt grinding machinery in the railroad industry. Belt grinders are being used to remove butt-welding flash from ribbon rail, as well as to grind rail ends in normal maintenance routine. Five, the development of the non-woven nylon wheel and roll, still under-

going evaluation but undeniably possessing great promise for imparting distinctive finishes to metals and many other materials."

Aleck Block, general manager, Merit Products, Inc., "New areas are being found every day . . . the newest of the new developments in connection with the flat wheel is . . . the presentation of the slashed flat wheel head."

J. F. Whitcomb, general manager, Coated Abrasive and Related Products Div., Minnesota Mining and Mfg. Co., "Standard metal finishes, entrenched by tradition but usually uneconomical to produce and maintain, will gradually give way to new, easily reproducible finishes at far less cost. The new finishes will result from (1) recent abrasive developments such as non-woven nylon, and (2) new constructions in the coated abrasive line."

E. A. Kowalski, sales manager, Chicago Rubber Company, Inc., "The coated abrasive manufacturers have been making tremendous progress in stock removal, and at the same time, superior finishes. We, of course, have followed along with better and better contact rolls. The most outstanding development taking place in our industry, the manufacturing of contact wheels, is the introduction of coated abrasives to use contact wheels on backstands at a great pace, showing tremendous savings and increase in production; and at the same time, superior finishing, less operator fatigue."

S. H. Miller, grinding and polishing machinery manager, Hammond Machinery Builders, "During '59, from the standpoint of light grinding, deburring and finishing, we feel there has been an interesting development in the use of abrasive belts to replace grinding wheels for many grinding and finishing operations."

Previously developed products often do not reach a point of acceptance for a number of years, such is the case of cemented diamond particle materials. Charles J. Koebel, president, Koebel Diamond Tool Co., "I believe a most significant development in 1959 in the grinding and finishing field has been the ever increasing use by industry of C.D.P., Cemented Diamond Particles materials."

James H. Flanders, ass't. to the president for engineering, Jones & Lamson Machine Co., "First, with regard to the significant developments in grinding and finishing applications during 1959, we have the following comment to make. We feel that the application of (Perpetual Form Control) truing equipment making use of CDP (Cemented Diamond Particles) cutters for the forming grinding wheels will become an increasingly important part of our grinder business. Installations to date have shown phenomenal savings in diamond costs."

Improvements in wheels so far as strength and bonds was mentioned by others than Elden Auker. J. B. Bair, president, Fox Grinders, Inc., "I feel that the most significant development in this field during the past year has been the introduction of vastly stronger grinding wheels. This has been accompanied by superior cutting qualities when used under very specific conditions of pressures and speeds."

N. G. Minehart, vice president, Abrasive Div. Besly-Welles Corp., "The development of treated abrasive grain, which has enabled us to offer Resinoid Bonded Discs and Wheels which are only slightly effected by strong coolants. This makes for longer lived abrasive members, and they wear evenly throughout their life. Work can be held to closer tolerances, and real savings are effected on abrasive costs."

G. E. Westerholm, vice president, Cortland Grinding Wheels Corp., "Although we do not believe that there will be anything new that will quite compete with the man-made diamond introduction referred to last year, we can certainly state that there has been plenty of new developments like the improvement of resinoid reinforced products, also in the field of steel conditioning, improved grinding wheels and safety devices that will enable the user to obtain greater efficiency under safe operating conditions."

Barrel finishing has had certain degree impact on the industry also. Again this appears to be not as much a development as it is the awakening of the user to the value of the process.

Joseph S. Imirie, vice president, Carborundum Co., "As forecast for the previous message, the emergence of barrel finishing applications represented the most significant development to the abrasive grain manufacturers in 1959. Loose abrasive, bonded media, compounds and machinery have all enjoyed growth."

R. P. Harty, vice president, Exolon Company, "There have been no significant new developments in the use of our products during 1959 except that the use of fused aluminum oxide in various barrel finishing techniques has continued to increase and the use of silicon carbide in sawing granite and other stones has shown a similar continuing increase."

Numerical controls have also found their application in grinding operations as stated by James K. Fulks, Executive Vice President, Ex-Cell-O Corp., "The most significant development during 1959 in the field of grinding was the application of numerical control to versatile contouring machines.

Miniaturization due to the space age is brought out by R. B. McConnell, Sr., honing engineer, Sunnen Products Co., saying, "We have noticed a decided increase in requirements for tooling for honing very small diameters. This is due in part to the space age miniaturization of pneumatic and fluid control components. One of our popular small honing stones, made in silicon carbide, aluminum oxide, and diamond, various grit sizes, bond types, and grades, measures .022" x .026" x .562". These small stones are used in recently developed honing tools for working down in the .098" bore diameter range."

H. I. Sole, manager of sales, Lapmaster Div., Crane Packing Co., expresses the opinion that the industry is holding its own in the established fields by saying, "We feel that the most significant developments in metal finishing during 1959 have been the necessity for much finer finishes than heretofore produced."

**Gaging**

Because of the additional comments on precision with regard to gaging we have grouped some of these comments together.

Herb Harig, president, Harig Manufacturing Corp. "The most significant developments in 1959 and extending into 1960 is more checking and gaging devices integrated into grinding equipment to speed-up production time and improve quality control."

R. B. Schofield, Industrial Sales, Airborne Instruments Laboratory, "We witnessed during the year 1959 the acceptance by a broad range of the precision manufacturing industry of the magneto-strictive actuator in the control of size on through-feed centerless grinding operations. Many successful installations applying feedback control to the magneto-strictive actuator were accomplished during 1959. In several instances this combination was applied to grinding machines working at linear feed rates which only two or three years ago would have been regarded as impossible. Naturally, continued improvements of both machine and grinding wheel contributed to this success."

From Federal Products Corp., "Perhaps the most outstanding development in Gaging for grinding machines during 1959 was the so-called 'Air-Fork' Gages for internal grinders. The fork-shape design of the gaging head (introduced from the chuck side of the work) permits it to remain in position during the grinding cycle without interfering with the wheel."

**Safety**

This area is not a yearly development, but can not be overlooked. In any industry safety is a continuing effort on the part of user and manufacturer alike. It has rightly been assessed by the following leaders as outstanding in 1959.

H. E. Giddings, sales manager, United States Rubber Co., "The most significant development in the grinding and finishing application during 1959, over and above the grinding strides made in safety and precision grinding, is the rapid strides made in the field of crush formed grinding. It is important to note that with the newly developed techniques on crush forming the grinding wheel industry is able to compete successfully with other types of precision forming."

Harley J. Hiscock, president, Fuller Merriam Co. explained it this way, "We feel that significant development in 1959 has been the greater emphasis on safety education. We think that there is a greater awareness on the part of field representatives of the necessity of assisting customers to promote the safe use of grinding wheels. We hope

that we are achieving more success in getting this message through to the people who use grinding wheels. It is very gratifying to note the work that is being done by your magazine in promoting grinding wheel safety. A continuation of this effort will be a great help in supplementing the work that's being done by grinding wheel companies and by the Grinding Wheel Institute."

**SALES — 1960**

The outlook for this year appears to be very good. The 60's will without a doubt be any one of the number of adjectives you have heard connected with its discussion. Our industry leaders have caution because of only two events coming this year. They are the pending steel problem and the possible lack of buying effort until the new developments are released at the Machine Tool Exposition—1960.

The over-all increase in this year's estimated business averages out to 22%. This is 2% higher than the predictions last year. It is worth noting that the predictions did not include as many extremes as last year. That is, there were not as many high and low percentages given.

A break down of the predictions show that the accessory manufacturers are the most confident with an increase of 37%. Machinery builders averaged about 25%, coated abrasive 20%, grain 23% and bonded abrasives the most conservative at 17%.

In comparing last year's predictions with the reported increase for the first nine months in 1959 we find that last year's predictions were substantially exceeded.

**1960 — ?**

Although there are remarks concerning new wheels with improved bonds and greater strength for higher speeds, more automation, standardization, new products, more safety, greater accuracy, and expansion of our industry into other areas of machining, there is no clear cut outstanding development in the comments we have received about 1960. We believe the clue is in J. K. Fulks remarks, "We are building some grinders of a type not now available as standard machines, but for which there is a definite market. These grinders are not being built for the 1960 Machine Tool Exhibition, but for customers who have work to put on them as soon as they're delivered."

**Precision**

We feel R. B. Schofield covered this area very well when he wrote, "While the progress in the control of grinding machines in general has been taking place at a rapid pace over the past few years, we feel that the year 1960 will witness even

**Wheels**

The greatest number of comments on any one subject for 1960 centered on grinding wheel development. As was stated last year, abrasives and machines do present a "chicken and egg" situation. This should be kept in mind during your study of the following remarks.

H. E. Giddings, "It is our feeling that the outstanding development in the grinding and finishing field in 1960 will center around new types of abrasive grain and the new types of bonding agents currently being evaluated in the laboratories of the grinding wheel industry."

Aleck Block, "The outstanding development in the field in 1960 will probably be the perfection of vitrified grinding wheels which are constructed with a new electrostatic process that orients the grain bonded into the wheel in a perfect radial direction, increasing the efficiency of the wheel approximately 30% and resulting in much cooler running."

R. H. Huntington, "Constant evolutionary changes are taking place in the grinding wheel industry. Super duty grains applied to many grinding applications promise to be a leading technical improvement for 1960—important although not spectacular."

**Machines**

After our comments on wheels it follows that we should present the remarks on machines. Again, you will note that the comments by the machine executives match that of the wheel people.

J. G. Blair, "I feel that during 1960 we will see these newer type wheels exploited to the fullest by the use of more precise, constant peripheral speed machines. I believe that we will also see significant changes in the area of higher operating speeds. These items will, of course, require better machinery specifically built to handle the wheels under these more demanding conditions."

**New Products and Applications**

This area might also hold some of the keys for 1960, but again there appears to be no one outstanding development which all have mentioned. If we can repeat, would like to point out the facts that developments are not a yearly occurance but there are trends which has been noted in several remarks and secondly the Machine Tool Exposition will be the scene of many new developments which have been merely hinted at in these pages.

Here are the comments which are noteworthy concerning new products and applications.

Alan C. Mattison, "The real break-throughs will be in abrasive-belt grinding as there are more new market opportunities there. Problems of increasing dimensional accuracy when machining high alloy steels, machining honeycomb without layover, and replacing obsolete methods of finishing nonmetallic materials create a clear-cut justification for equipment spending."

J. F. Claydon, "Expansion of abrasive belt grinding or machining into new areas of application. Specifically, the attainment of better economics in terms of cost of stock removal through improved performance of coated abrasives and new methods concepts."

Robert D. Lawson, "There is one area of grinding which I feel is one to watch during 1960. That is the use of diamond impregnated rolls for truing form wheels. The use of these rolls will make it possible to true many shapes on wheels which would be difficult with crush truing of conventional forms bars with single diamonds." • • •

Detroit Broach

# Eliminates Burning, Loading

## With Wheel Treatment

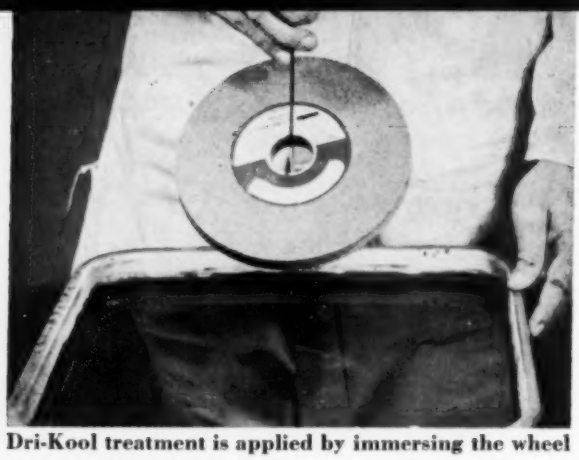
Detroit Broach, a company which is in a highly competitive tool field, requires close scrutiny of every machining operation. The application of a Dri-Kool wheel treatment has resulted in eliminating their burning and loading problems while saving wheel life and man hours.

● In the highly competitive field of broach manufacturing, every operation requires close scrutiny for quality and cost. Detroit Broach & Machine Co., Rochester, Michigan, one of the leaders of this field has recently been rewarded for their continual search for new methods or equipment with which to produce a higher quality while holding the price line. The problems at this company were those common to most manufacturers in that it was necessary to grind broaches of extreme hardness (64 to 68 Rockwell "C") without developing burns, chatter marks and obtain the best possible finish. The materials involved were such abrasive resistant types as M3, M4, and T15. With these materials, there are still other problems such as holding the wheel shape, production and the age old problem of finding a standard wheel. The search for the answer to these problems resulted in the trial and ultimate use of a wheel treatment called Dri-Kool, a synthetic colloidal graphite wheel treatment manufactured by King Graphite Products, Inc., Trenton, Michigan.

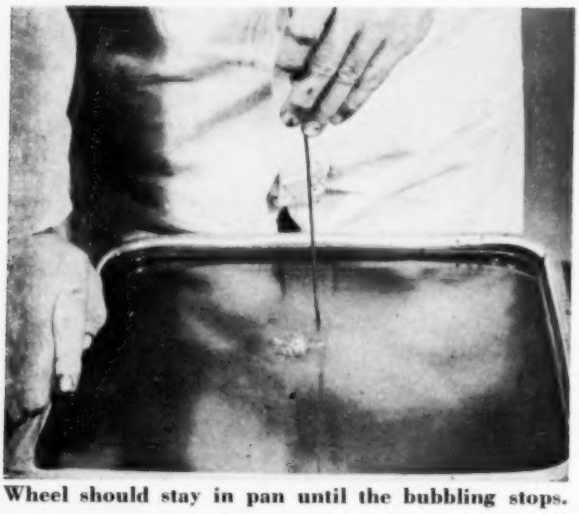
Although tests are still being conducted on other operations at Detroit Broach, two operations have proved the value of this new treatment. One is the grinding of the rear pilot of the stripper broach. This stripper broach is 9/16" in diameter by 12" long. The material is M-3 hardened to 64-68 Rockwell "C". The grinding of the rear pilot of this broach required the removal of 015" stock on the OD holding size within .0002". The operation is performed on a Brown & Sharpe Model No. 5 plane grinder. A broach was placed between centers and a water soluble coolant was used. The wheel used was a 14" x 1" x 5" aluminum oxide, 70 grit, K hardness vitrified bond. Previous to impregnating the wheel with Dri-Kool, the operation required roughing two broaches, then dressing and finishing the two broaches. This operation is now run by roughing three broaches, dressing and then finishing three broaches. Any burning that had resulted in this operation previous to the use of the treatment has now been eliminated. Finish obtained has been vastly improved.

The other tool which Detroit Broach feels exemplifies the use of the treatment in the wheels is a "Roto-cut" broach which is made of M3 material. On this broach there are 18 to 20 bearing surfaces which require stock removal of .018" to .020" on the OD which is held to within .0002". There is no tolerance allowed for centricity. The location of these bearing surfaces are held to a total of .005" from the end face of the broach. No run out is allowed for these surfaces. This tool is also ground on a No. 5 Brown & Sharpe plane grinder. The size of the wheel is 14"x1½"x5" which is dressed on each side to the width required. The wheel is again an aluminum oxide, 70 grit, K hardness, vitrified bonded. This being a plunge type operation, the stock removal, loading or glazing and finish were the main problems. The Roto-cut

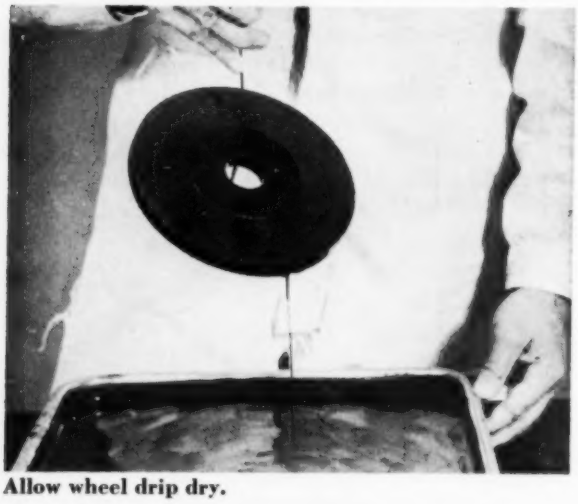
**Highly skilled operator at Detroit Broach conducted tests of the treatment on this Brown & Sharpe No. 5 grinder. Tests showed an elimination of burning and loading.**



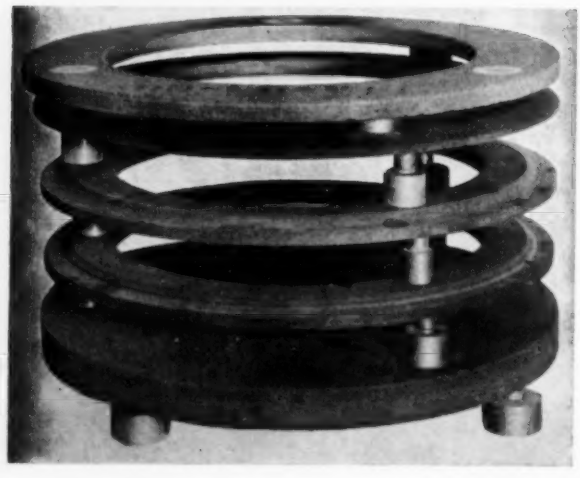
**Dri-Kool treatment is applied by immersing the wheel in a pan of the treatment.**



**Wheel should stay in pan until the bubbling stops.**



**Allow wheel drip dry.**



**When dripping stops wheels should be laid flat or stacked as shown in a dry room in about 70° temperature for 28 to 48 hours.**

Broach is 2.542" diameter by 11¼" long and those with 18 bearing surfaces required 5 to 6 dressings for rough and 3 dressings for finish. Because it was a plunge cut, they could not move off the grinding surface and therefore the action was not as free-cutting. Excessive time and wheel were consumed in number of dressings required. Now through the use of the Dri-Kool treatment, two dressings are required for rough and only one for finish.

Dri-Kool is a true colloidal graphite dispersion in a volatile corner. The synthetic graphite particles are in a uniform thickness range of between 80 and 100 Angstrom units. This is 1/125th and 1/100th of a micron. In the process of obtaining this extremely small particle size, the graphite particles take on a negative magnetic charge and will not coagulate.

The application of this treatment to the wheel is rather simple in that Dri-Kool may be applied either by pouring on the wheel until it appears on the opposite side, or by immersing the wheel in a pan of Dri-Kool. The wheel should stay in the pan until the bubbling is stopped; the wheel should then be removed and allowed to drip. When the dripping stops, the wheel should be laid flat in a dry room at a temperature of approximately 70° for 28 to 48 hours, this depending on the size and density of the wheel. The wheels will dry in any area, but will take longer. Dri-Kool will not wash out—in fact it is very difficult to remove under any circumstances. The dynamic balance of the wheel will not be affected as the Dri-Kool will coat all pores and connecting surfaces but does not completely fill the pores. For vitrified bonded wheels a Dri-Kool treatment will last for the life of the wheel. However, close grained wheels of resinoid or rubber bonds that have no inner connecting passage ways for the treatment to penetrate thoroughly will need repeated overnight soaking. Dri-Kool B, in pressurized cans, may also be applied periodically to these wheels as a coating. No wheel is too large for the treatment. It should be noted, however, that the drying time for larger wheels must be increased. The drying time, however, can be shortened by storing flat in a dry-warm, well ventilated area, and by using various means to expose maximum wheel area to air circulation. This circulation could be provided by an electric fan. The Dri-Kool treatment will change the wheel color to black.

The use of graphite as a lubricant has been well known throughout the years. However, the extremely fine size range of the molecular graphite particles used by the King Graphite Products treatment and the negative charge developed in these particles makes an extremely fine lubricant which reduces frictional heat developed in grinding. The treatment also provides a thermal conductor that disperses heat through-out the wheel surfaces where it is emited by radiation.

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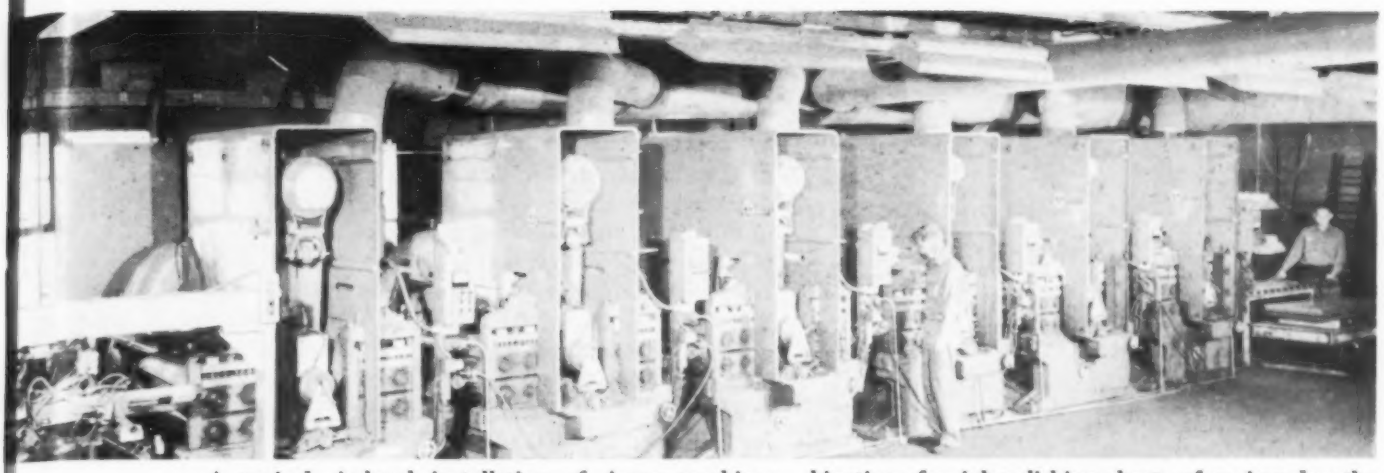


A typical six-head installation of Acme machines like those above provides a wide variety of belt combinations for job-polishing sheets of various lengths and widths at relatively low cost.

# Slash Costs with Flat Polishing

**Flat polishing with abrasive belts is a versatile, cost-slashing method for roughing and finishing metal. Stock removal can be on the order of 15 to 30″ "tenths" and finishes as low as 4 RMS.**

By EARL D. HOSKIN
Service Engineer
Michigan Abrasive Company

● When the abrasive flat-polishing process is able to cut a company's metal finishing and polishing costs from approximately $64.00 per thousand square feet to a little over $10.00 per thousand, it becomes a process that merits serious consideration. Over a year's time, savings like these point up significant cost reduction possibilities.

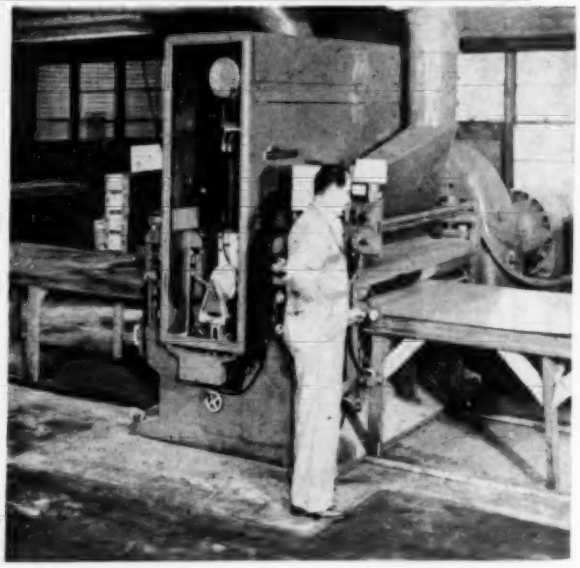
Although there have recently been developed a number of advanced techniques in the process, it is still generally regarded as something that only large manufacturers can apply profitably. Medium and even small manufacturers, however, can use the process to advantage, on machines scaled to their needs.

Essentially, the flat-polishing process is a combination of two machining methods—metal removal or sizing, and surface conditioning. For example, conventional metalworking methods might call for a sequence of milling to form and size, followed by grinding or lapping for finish. In flat polishing, one basic machine does both metal removal and surface polishing.

Inherent in the flat-polishing process is its dramatic ability to cut costs. It eliminates the need for a number of secondary operations and for special equipment needed to prepare formed pieces for plating. With flat polishing, raw material is received from the mill, processed, and is ready for plating or other finish after it is formed. If, for example, conventional metal finishing methods were used in preparing a bumper wing-end surface for plating after it was formed, a special machine with 14 to 22 different stations would be required to finish the part from all positions. The cost of this special equipment must be amortized over the production requirements, and in many cases would be prohibitive.

Flat-polishing equipment is versatile. Installed and operating properly, it represents an investment that can substantially improve a company's competitive position. It is not equipment confined to one job only. Benefits are derived from the number of other uses to which it can be applied, as well as directly from its ability to cut steel finishing costs. Flat polishing conditions metal surfaces to accommodate dies, materially improving forming and fabricating. It is also used for up-grading the surface quality of less expensive materials and for salvaging metal stock accidentally damaged in shipment or handling.

In analyzing whether or not flat polishing as a manufacturing process can pay its own way in a plant, careful attention must be given to this versatility. Take, for example, a finish and cost requirement where the metal must be polished to an acceptable surface for plating prior to forming. The user has an option of buying either hot pickled steel or cold rolled steel. Both need surface conditioning in order to be acceptable for plating. On an actual cost outlay at today's prices, the user



**One basic machine removes metal as well as imparts the desired surface finish in the flat-polishing process. Here a 72-inch wide single-head Acme machine is being used to simultaneously size and polish a wide sheet.**

can purchase hot rolled steel, flat-polish it ready for plating at a cost of approximately $2.00 per ton more than the basic price of cold-rolled steel, which still needs surface conditioning for plating.

For improving metal-forming operations, flat polishing imparts a metal surface that eliminates a great deal of die friction. Not only does this lengthen die life, but it also improves the quality of the parts produced. Just recently, a small job-stamping company is reported to have bid successfully on the production of parts with critical surface requirements that its larger competitors could not match. The successful bidder pre-polishes the steel he uses.

**Uniform Finishes**

Experience has shown that the flat-polishing process economically produces uniform finishes with surfaces as low as 4 rms. The plating technique to be used, of course, determines the surface requirement. For painting, the uniformly fine finish produced by flat-polishing provides a surface that aids paint adhesion. Paint manufacturers use flat-polished steel to evaluate the levelling characteristics of their products.

Welding engineers believe that the improved quality and work production that results from pre-polishing metal to be welded by the Heliarc process stems from reducing blow holes caused by the welding process. It is believed that the cause of these holes is minute surface imperfections of the metal. Flat polishing substantially reduces these imperfections.

Modern flat-polishing machines have the ability to size metal as required, being engineered to hold tolerances of $\pm 0.0001''$. With proper handling equipment, coil stock as well as sheets at least two feet long or longer can be processed. Coil and sheet width is determined by the width of the machine.

Flat polishing has recently been tested to determine whether or not it could reduce the amount of primer paint required to coat raw metal. Tests have also been conducted to determine whether the process could be used to eliminate the pickling process used in steel mills for the removal of scale. Although results of these tests are inconclusive at this point, they indicate the different directions that the study of flat polishing for cost cutting is taking. Product designers, spurred by the increasing sophistication of consumers in the quality of goods demanded, are constantly calling for better surface finishes that have both functional use and eye appeal. Flat polishing not only holds promise for filling this demand, but it can also serve as a real cost-cutter in applications yet to be discovered.

**Machines Improving**

Machine tool builders are constantly improving flat-polishing machines by incorporating engineering features to improve the quality and quantity of work produced and to broaden the process application base. Working along with the builders and the users, suppliers of coated abrasives have been making advances to give users a product that will let them achieve the process potential.

Not only have material improvements been introduced by the coated abrasives industry, but substantial reductions in the costs of abrasives have also been achieved. As an illustration, on a per-piece basis, pre-World War II abrasive costs per bumper were averaging from 50¢ to 60¢ per bumper. Now, abrasive costs are down to as little as 2¢ per bumper. During the same period, surface areas of bumpers have increased about 400%, on the average.

**Abrasive is Cutting Tool**

The coated abrasive belt is the cutting tool with which a flat-polishing machine does its work. Actually, it is the basis for the flexibility of the process, because the different types and grades of abrasives available give the machine its ability to work on various material. The user can shift belts with great ease to meet varying production requirements.

To realize maximum return from his investment in flat-polishing equipment, the user must utilize suitable abrasives. By working closely with the coated abrasive manufacturers, he can eliminate a costly trial-and-error process to determine the proper sequencing of work. Normally, in flat-polishing work, stock removal requirements vary from 0.0015" to 0.003". For long production runs on a multiple-head installation, and depending on the finish required, a job of this type would probably start with a grit size of 60 or 80 for roughing and might end with 240 or 280 for final finishing.

Aluminum oxide is generally used on roughing cuts because of its toughness and wear characteristics under work load. In sustained use, it begins to lose its peculiar cutting characteristic

and the resulting surface is a wide scratch pattern that is difficult to cover properly in plating.

Silicon carbide is used for finishing passes, especially on dry operations, because it is a hard, friable material. Under a work load, its friability contributes to a wear characteristic that fractures the grain, always maintaining a clean, sharp cutting edge. The resulting scratch pattern is clean and narrow. Plating this surface produces a scratch-free finish.

Because silicon carbide has more of a tendency to fracture under heavy work pressure, it is extremely important that finishing pass pressure be rigidly controlled to produce optimum results. This requires that the material leave the final roughing head with as low a finish as is economically possible.

**Final Roughing Pass Critical**

This final roughing pass is perhaps the most critical in determining final outcome of the work. Unlike silicon carbide, the metal removal rate of aluminum oxide is in direct proportion to its linear travel. Final roughing belts should be carefully watched so that they are not used beyond their useful cutting life. Measured in terms of metal removal over distance traveled, silicon carbide also drops in direct proportion to belt travel, but after reaching a particular level, the trend line has a tendency to flatten out. Total metal removal of a silicon carbide belt generally exceeds that of a comparable aluminum oxide belt.

**Belt Costs Only One Factor**

Belt costs are commonly evaluated on the basis of number of pieces per belt. If this is the only evaluation used, the user may not get the true picture of the entire cost of his operation. For an over-all cost picture, the user should also consider total production, either in number of pieces or square feet produced. As an example of what total cost evaluation can do, consider a standard 15-head line. Operating costs on a line of this size run from $100.00 to $150.00 per hour. This includes the burden rate, labor maintenance and coated abrasive costs. On the average, coated abrasive costs run from 14% to 20% of the operating costs. In one typical application, the reject rate was running about 33%. The rejected material had to be re-handled and run through again. This meant that effective production was only 67% on an operating cost of approximately $187.00 per hour.

After some experimenting it was found that the belts were being run too long for the requirements of the job. When they were removed at half-life and replaced with new ones, reject rate went down to 5%. By doubling belt costs, the user was able to save himself a little over $12.00 per hour in total operating costs.

It is common practice in flat-polishing operations to extend belt life by progressing the belts to subsequent heads as they wear. Unless the user has equipment to measure on-the-job metal removal, it takes a great deal of operator skill and experience to determine proper belt use. The

**Surfaces as low as 4 RMS can be economically produced by the flat-polishing process.**

operator often tends to let the belts run longer than optimum, with the resulting finish not quite up to par.

Usually it is the belts used in the roughing passes that are overextended in use. At this stage, cutting action is not sharp and clean, resulting in what is called metal pick-up or weld. The metal welds itself to the grain and gouges out additional metal in moving over the surface. As it welds to the grain, the belt also rips out a minute sliver. Although this surface imperfection may not be visible after the piece is finished, it will show itself after plating. It is possible that this action is similar to that experienced with cutting tools—as the cutting edge wears, the tool becomes duller and more heat is generated in the cutting process.

As more developments come from further testing of new ideas and techniques in flat polishing, users will reap additional benefits. Its applications are becoming more and more varied as the number of available combinations increases.

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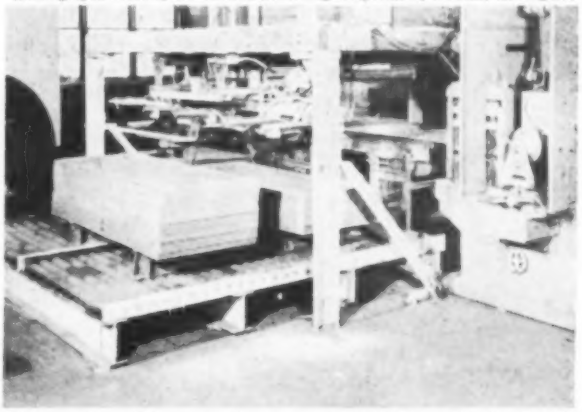
(Photographs courtesy Production Finishing Corporation, Detroit, Michigan.)



**Proper handling equipment materially aids in loading and indexing sheets to meet maximum production requirements.**

# Standard Time Data For Grinding Part II

This second part of the Standard Time Data series covers the application of the data to surface grinding with a vertical spindle machine of the Blanchard type. Part I which was presented in the December issue described standard time data and covered the application of tool touch-up. Other parts will cover application to cylindrical, snagging, surface, and centerless grinding.

By E. A. CYROL and R. L. BORCK
E. A. Cyrol & Co., Chicago, Ill.
Management Consultants

● Production standards applied to Blanchard grinding operations can be correct for the "average" conditions only. The castings as they come from the foundry cleaning room vary to the extent that a standard may be "too loose" for the exceptionally good casting and "too tight" for the casting that is too thick or is rough so that excessive clean-up is necessary. This variation should come only in the grinding time. The manual times are considered valid as long as the elements remain as described here.

**Description of Work Elements**

1. Load & Unload to Magnetic Chuck or Fixture from Floor

This time was found to vary with the weight of the casting handled. The time includes all the time from the instant the operator touches the part on the chuck or fixture, places it on the floor or flat or in a tote pan, picks up the the next piece from the floor or tote pan, places that part on the chuck or on the fixture, and releases it there.

Parts over sixty pounds in weight are to be handled with an overhead hoist that is provided.

**Time Values for Blanchard Grinding Elements**

**1. LOAD & UNLOAD TO MAGNETIC CHUCK OR FIX. FROM FLOOR**

| Wt. | Time | Wt. | Time | Wt. | Time |
|---|---|---|---|---|---|
| 2 | .11 | 22 | .19 | 42 | .27 |
| 4 | .12 | 24 | .20 | 44 | .27 |
| 6 | .13 | 26 | .21 | 46 | .28 |
| 8 | .14 | 28 | .21 | 48 | .29 |
| 10 | .14 | 30 | .22 | 50 | .30 |
| 12 | .15 | 32 | .23 | 52 | .30 |
| 14 | .16 | 34 | .24 | 54 | .31 |
| 16 | .17 | 36 | .24 | 56 | .32 |
| 18 | .17 | 38 | .25 | 58 | .33 |
| 20 | .18 | 40 | .26 | 60 | .34 |

1a. Position & Remove Holding Bars on Magnetic Chuck

After the chuck is loaded with parts, holding bars are normally required to aid in holding the parts in place. This element covers the getting and placing of bars on the chuck in position and removing them after the grinding is accomplished.

**POSITION & REMOVE HOLDING BARS ON MAGNETIC CHUCK**

| No. of Bars | Total Min. Allowed | No. of Bars | Total Min. Allowed |
|---|---|---|---|
| 2 | .19 | 18 | 1.05 |
| 3 | .25 | 19 | 1.10 |
| 4 | .28 | 20 | 1.18 |
| 5 | .31 | 21 | 1.26 |
| 6 | .34 | 22 | 1.34 |
| 7 | .36 | 23 | 1.43 |
| 8 | .39 | 24 | 1.51 |
| 9 | .43 | 25 | 1.58 |
| 10 | .49 | 26 | 1.67 |
| 11 | .55 | 27 | 1.75 |
| 12 | .61 | 28 | 1.85 |
| 13 | .68 | 29 | 1.95 |
| 14 | .76 | 30 | 2.04 |
| 15 | .81 | 31 | 2.10 |
| 16 | .88 | 32 | 2.24 |
| 17 | .95 | | |

2. Load & Unload Magnetic Chuck or Fixture from Table.

This time also varies according to weight of the part. This time includes all time from the instant that the operator's hands touch the part, remove the part to the table, pick up the next part from the table and place it on the chuck or position it in the fixture. In the time study observations, the watch was read at the moment the hands let go of the part.

In both of the above elements, more than one part may be loaded or unloaded at the same time. Several pieces may be placed on the chuck and then arranged in positions to be best held by the magnetic field. When this

**LOAD & UNLOAD MAGNETIC CHUCK FROM TABLE**

| Wt. | Min. | Wt. | Min. | Wt. | Min. |
|---|---|---|---|---|---|
| 2 | .06 | 22 | .13 | 42 | .20 |
| 4 | .07 | 24 | .14 | 44 | .21 |
| 6 | .07 | 26 | .14 | 46 | .21 |
| 8 | .08 | 28 | .15 | 48 | .22 |
| 10 | .08 | 30 | .16 | 50 | .23 |
| 12 | .09 | 32 | .17 | 52 | .24 |
| 14 | .10 | 34 | .17 | 54 | .24 |
| 16 | .11 | 36 | .18 | 56 | .25 |
| 18 | .11 | 38 | .19 | 58 | .26 |
| 20 | .12 | 40 | .20 | 60 | .27 |

was done, the watch reading was made when the last piece was positioned and the operator began reaching for the holding blocks or the wrench to tighten the holding device on the fixture.

3. Remove Nut & Washer, Spacer or Strap & Replace .46 Min.

When a fixture is used, a nut may be needed to hold the part fast in the fixture. The nut is completely removed and set aside either on the chuck or table. This includes also the time required to pick up the wrench and set it aside.

4. Loosen and Tighten Nut Only .23 Min.
Index Chuck .03 Min.

When a nut does not have to be completely removed but merely loosened and tightened, the time of 0.23 minute was found to be correct. An illustration of how these time values add up can be had by taking an actual time study of Part No. A-3550 Water Outlet Connection. Elements 2, 3, 8, and 9 are the positioning and securing elements. For 16 pieces the time amounts to 3.24 plus 1.04 plus 0.86 plus 1.07 or 6.21 minutes. From tables 1, 2 and 3, we get the following: 16 x .12 plus 15 x .03 plus 16 x .23 or 6.05 minutes.

5. Position Chuck Under Grinding Wheel (Parts held on Magnetic Chuck or Fixture)

This element is performed immediately after the loading and placing of holding bars elements. The work is brought under the wheel for the first time. The operator must exercise some care not to hit an oversized part with a wheel segment and cause damage. Some experimentation showed that the best procedure is to raise the wheel well above the work, feed the chuck under the wheel rapidly, and lower the wheel to the work slowly. The chuck should revolve at its highest speed during this time—33 R.P.M.

This element has all time required from the instant that the holding bars are positioned to the time when the wheel is lowered to touch the work. The chuck R.P.M. is reduced

**POSITION CHUCK UNDER GRINDING WHEEL—PIECES ON CHUCK**

| No. of Pcs. | Min. | No. of Pcs. | Min. |
|---|---|---|---|
| 1 | .30 | 31 | .41 |
| 4 | .31 | 34 | .42 |
| 7 | .32 | 37 | .43 |
| 8 | .33 | 40 | .44 |
| 10 | .34 | 43 | .45 |
| 13 | .35 | 46 | .46 |
| 16 | .36 | 49 | .47 |
| 19 | .37 | 52 | .48 |
| 22 | .38 | 55 | .49 |
| 25 | .39 | 58 | .50 |
| 28 | .40 | 60 | .50 |

**POSITION CHUCK UNDER GRINDING WHEEL—PIECES IN FIXTURE**

| No. of Pcs. | Min. | No. of Pcs. | Min |
|---|---|---|---|
| 1 | .26 | 9 | .29 |
| 2 | .26 | 10 | .29 |
| 3 | .27 | 11 | .29 |
| 4 | .27 | 12 | .30 |
| 5 | .27 | 13 | .30 |
| 6 | .28 | 14 | .30 |
| 7 | .28 | 15 | .31 |
| 8 | .28 | 16 | .31 |

and the coolant is started after the wheel makes its initial contact with the work, or during the "grinding time."

6. Grinding

Only guiding rules can be given. The graph in Figure 8 shows the approximate relation between the area of metal ground and the feed

**ALLOWED TIME FOR "DWELL" OR "SPARK OUT"**

(Area Being Ground = Total Area = No. Pcs. x Area of Pc.)

| Area Sq. In. | Min. | Area Sq. In. | Min. |
|---|---|---|---|
| 20 | .17 | 320 | .56 |
| 40 | .20 | 340 | .58 |
| 60 | .23 | 360 | .61 |
| 80 | .25 | 380 | .63 |
| 100 | .28 | 400 | .66 |
| 120 | .30 | 420 | .68 |
| 140 | .33 | 440 | .71 |
| 160 | .35 | 460 | .74 |
| 180 | .38 | 480 | .76 |
| 200 | .41 | 500 | .79 |
| 220 | .43 | 520 | .81 |
| 240 | .46 | 540 | .84 |
| 260 | .48 | 560 | .87 |
| 280 | .51 | 580 | .89 |
| 300 | .53 | 600 | .92 |

that can be used. This, of course, is only a guide. The highest feed should be used without burning the work and without overloading the machine as shown by the amperes of current drawn by the motor during grinding.

Throughout the period of time study, an 18-inch, 8-segment A-24-J8 aluminum oxide wheel was used.

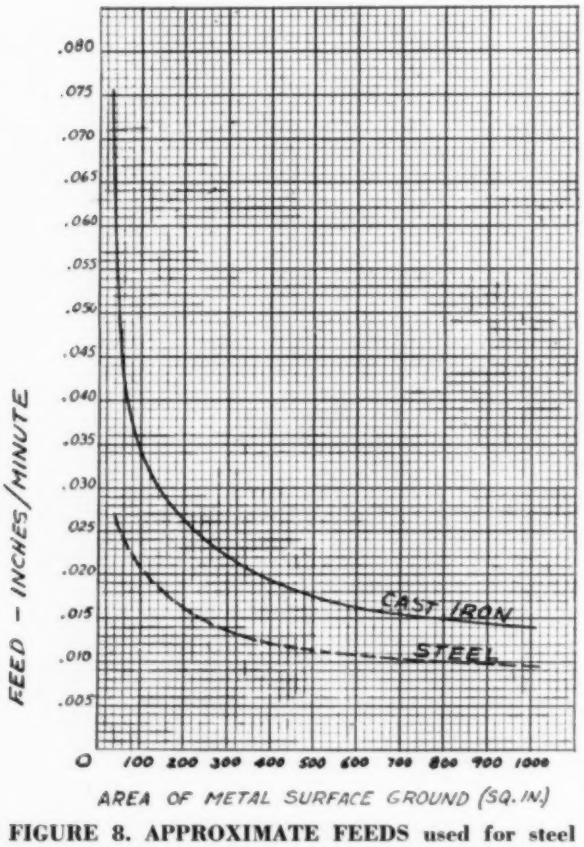



**FIGURE 8. APPROXIMATE FEEDS used for steel and cast iron during study of Blanchard operations. Calculation of the actual grinding element can be done using curves like this and the known wheel breakdown diagonal stock removal rates for the operation.**

Although wheel wear cannot be definitely established, it is suggested that 0.015" be considered worn off the wheel for every 0.125" removed on a cast iron surface. In the case of steel forgings, it is suggested that 0.050" be considered worn off the wheel for every 0.125" metal removed.

The formula for grinding time is as follows:

$$\frac{\text{Stock Removed} + \text{Wheel Wear}}{\text{Feed in Thousandths Per Min.}} = \text{Minutes of Grinding Time}$$

7. Bring Work Out to Check Dimension

It is sometimes necessary to check the dimension of the parts or part being ground. The feed of the grinding wheel is sufficiently exact to permit any but close tolerance work to be ground to size without checking. However when tolerances within .005" to .010" are required, the part must be checked because the wear of the wheel is indeterminate. The chuck must be brought out from under the wheel, the splash guard moved out of the way, and one of the parts on the magnetic chuck measured. Since the grinding wheel moves in a plane that is parallel to the surface of the chuck, only one part needs to be measured and a safe assumption be made that all the rest of the parts are the same.

The time varies according to the number of parts on the chuck and includes all the time necessary to disengage feed, move wheel up, allow the chuck to revolve several times to permit a certain amount of the grinding grit to be washed away, feed out the chuck, open the splash guard, pick up scale and measure.

**BRING WORK OUT TO CHECK DIMENSION**

| No. Pcs. on Chuck | Min. | No. Pcs. on Chuck | Min. |
|---|---|---|---|
| 2 | .11 | 34 | .15 |
| 6 | .12 | 38 | .16 |
| 10 | .12 | 42 | .17 |
| 14 | .13 | 46 | .17 |
| 18 | .13 | 50 | .18 |
| 22 | .14 | 54 | .18 |
| 26 | .14 | 58 | .19 |
| 30 | .15 | 60 | .19 |

8. Check with Profile Gage or Scale or Check with Mikes

| | |
|---|---|
| **CHECK WITH PROFILE GAGE OR SCALE** | **0.14 Min.** |
| (Allow only once per load per check) | |
| Check with mikes (Depth) | 0.50 Min. |
| Check with mikes (O.D.) | .21 Min. |
| Check with mikes (I.D.) | .27 Min. |

9. Reposition Chuck under Grinding Wheel after Checking .18 Min.

This element includes bringing the work back under the grinding wheel, feeding the wheel down to the work, closing the splash guard, starting the coolant, and engaging the automatic feed.

# Grinding and Finishing

**JANUARY, 1960**

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| 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 |
| 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 |
| 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 |
| 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 |
| 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 |
| 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 |
| 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 |
| 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 |
| 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 |

**EQUIPMENT & LITERATURE ITEMS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

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| 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 |
| 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 |
| 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 |
| 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 |
| 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 |
| 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 |
| 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 |
| 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 |
| 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 |

**EQUIPMENT & LITERATURE ITEMS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

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10. Bring Work Out for Unload

This element is very similar to the element of bringing work out to check; however, this element allows additional time for washing the parts with coolant more thoroughly than in the previous element. This time varies according to the number of parts on the chuck.

This element does not cover time required to wash out grit in a part such as the mixer valve manifold.

**BRING WORK OUT FOR UNLOAD**
(Time allowed for washing & grinding grit off Parts with coolant)

| No. Pcs. on Chuck | Min. | No. Pcs. on Chuck | Min. |
|---|---|---|---|
| 1 | .35 | 32 | .46 |
| 2 | .35 | 34 | .47 |
| 4 | .36 | 36 | .47 |
| 6 | .37 | 38 | .48 |
| 8 | .38 | 40 | .49 |
| 10 | .38 | 42 | .49 |
| 12 | .39 | 44 | .50 |
| 14 | .40 | 46 | .51 |
| 16 | .40 | 48 | .52 |
| 18 | .41 | 50 | .52 |
| 20 | .42 | 52 | .53 |
| 22 | .42 | 54 | .54 |
| 24 | .43 | 56 | .54 |
| 26 | .44 | 58 | .55 |
| 28 | .45 | 60 | .56 |
| 30 | .45 | | |

BLANCHARD GRINDER STANDARD DATA SHEET

| | | | | |
|---|---|---|---|---|
| PART NAME | | | PART NO | |
| OPERATION | | | OPER NO | |
| MACHINE | MACHINE NO | DATE | MATERIAL | |
| WEIGHT OF PART | GRINDING AREA/PC | PIECES/LOAD | TOTAL AREA | |
| RECOMMENDED FEED | CHUCK SPEED | STOCK REMOVED | EST WHEEL WEAR | |

| ELEMENT DESCRIPTION | TIME | OCC. | ALLOWED TIME |
|---|---|---|---|
| LOAD & UNLOAD - FF - TT - FIX (HOIST 0.9#) | | | |
| SECURE | | | |
| INDEX | | | |
| BARS ON & OFF | | | |
| POSITION CHUCK UNDER WHEEL | | | |
| GRIND | | | |
| GRIND - NO FEED | | | |
| FEED OUT TO CHECK | | | |
| CHECK | | | |
| REPOSITION UNDER GRINDING WHEEL | | | |
| BRING WORK OUT ( WASH ) | | | |
| CLEAN CHUCK | | | |

| DOWN TIME ALLOWANCE | MINUTES | TOTAL ACTUAL TIME PER PIECE | |
|---|---|---|---|
| PERSONAL | 20.00 | PLUS _____% ALLOWANCE | |
| UNAVOIDABLE DELAY | 15.00 | TOTAL ALLOWED TIME/LOAD | |
| MISCELLANEOUS | | STANDARD HOURS PER PIECE | |
| | | SET UP TIME IN HOURS | |
| TOTAL DELAY TIME | | DATE STANDARD ISSUED | |

| REMARKS | SET UP DATA | STD. HOURS |
|---|---|---|
| | NO FIXTURE USED | |
| | FIXTURE USED NO._____ | |
| | LOWER WHEEL (8 SEGMENT) | |
| | CHANGE WHEEL | |
| | CLEAN MACH &CHANGE COOLANT | |

OLD SETUP STD.____OLD RATE____NEW SETUP STD.____NEW RATE____CALCULATED BY____

**FIGURE 9. STANDARD DATA WORK SHEET developed from the Blanchard study for use in production estimating. Efficiency of standard data system depends on well-designed work sheet.**

11. Clean Chuck .31 Min.

After a load of parts is ground to size and removed from the chuck, the chuck must be cleaned. The usual procedure for this operation is to flood the chuck with coolant and then bring the chuck out to where the operator can wipe the chuck with a rubber strip about 10 inches long.

12. Punch In & Out 3.00 Min.

After a job is complete, the operator marks his ticket with the production completed, goes to the dispatcher's booth for a new job, gets his new assignment and returns to work. He may measure a part to check the amount of stock to be removed before he starts in to work. This time was found to be about 3 minutes per occurrence. Adding 7.9% allowance gives 0.054 hour. For simplicity in record keeping, the time adopted will be 0.06 hours.

13. Position Fixture on Chuck & Level 4.00 Min.

When a fixture is required, the operator will have to place it on the chuck with hoist in most instances. This time is (3.00 min. + 4.00 min.) x 107.9% or 0.125 hours. The 3.00 minutes is for punch In & Out as above. Use 0.13 hours.

14. Lower Wheel 10.00 Min.

As the grinding wheel is used the segments are reduced in length through wear and dressing. When the segments become too short for further use, they must be lowered. The time for this is (10.00 min. + 3.00 min. x 107.9%) 14.03 minutes or 0.23 hours.

The operator is permitted to punch in and out on this job and report his time.

15. Clean Machine 63.00 Min.

Whenever necessary, The Blanchard Grinder must be cleaned of the accumulated sludge and the coolant consisting of water and soluble oil must be changed.

The operator is allowed 63.00 minutes for this operation. This time permits him to get empty barrels from the yard—some wait and search for barrels allowed—and make all necessary preparations. The standard allowed is (63.00 x 107.9%) or 1.13 hours.

16. Change Grinding Wheel 15.44 Min.

After a grinding wheel is completely used up, the operator removes the worn-out wheel and replaces it with a new one. The time for wheel change given here is good only for the 8 segment wheel that was used during our time study observations.

The time of 15.44 includes 3.00 minutes for checking in and out and get ready as well as getting the new wheel, cleaning the machine after the changeover, and cleaning the area near the machine.

The standard for a wheel change is (15.44 min.) 0.26 hours. • • •

---

This is the second of a five-part series on Standard Time Data for Grinding. The following parts will cover cylindrical, snagging, surface and centerless grinding. Reprints of the complete series will be available upon completion of publication. Price of quantities up to 25 will be $1.00 each. Discount will be made for larger orders.

# Right Size Wheels CUT Grinding Costs

**Many users could cut grinding costs and improve efficiency by checking their wheel size specifications along the lines suggested below. In grinding, getting the right size and the right shape of wheel to do the job safely and efficiently is of equal importance with choosing a wheel of the proper abrasive, grit grade and bond.**

By E. S. AVERY
Vice President
Waltham Grinding Wheel Company

● Most discussions of grinding wheel selection are centered primarily on the grit, grade, structure and bond of the wheel, ignoring size and shape. Wheel specifications are important, but they are only one part of the story.

All too often the dimensions and shape of the wheel are regarded as being fixed by the grinding machine and by the safety code. There is a considerable element of truth in this. Within limits, the design of the machine does dictate the wheel size, but not to just one size and shape of wheel.

Similarly, the Safety Code prescribes limits for the sizes of wheels, but within these regulations there is also room for variation. One point cannot be emphasized too strongly: any wheel must meet the regulations of the Safety Code. No manufacturer will recommend, and no user should use a wheel which does not meet these requirements. Within these boundaries, however, there are six basic dimensional considerations which influence grinding costs.

### Use Standard Sizes and Shapes

This sounds like a self-evident truth, but the number of odd size or non-standard wheels that are sold is substantial. The Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio has issued a 76-page bulletin entitled "Standard Shapes and Sizes of Grinding Wheels." This Simplified Practice Recommendation (R45-57) has been accepted officially by some 400 manufacturers, distributors, and users of grinding wheels. In the long run all users will benefit by buying wheels established as standard.

For one reason, *non-standard* wheels usually cost more. A 13" x 2" x 1¼" wheel may be just what you think you need, and what has been used on grinding machine "X" since it was put into operation. Most wheel manufacturers have molds to make 12" diameter and 14" diameter wheels. The 13" diameter wheel must be made 14" diameter and cut to 13". So the customer most usually pays for 1" of wheel which he does not get. Similarly a 20" x 1⅞" x 12" cylindrical wheel is non-standard and is priced as a 20" x 2" x 12" wheel.

Another reason for using standards is that it makes for easier and quicker replacement. The wheel manufacturer or his distributor is much more likely to have standard sizes on hand, or blank stocks which can be altered readily to a standard size. When time is money—when costly machine tools are standing idle—this can be a definite plus factor.

### Know the Standard Shape Types and Use Them To Advantage

There is a wide enough variety of standard types and grinding wheel faces to handle almost every conceivable grinding operation. Some of these are illustrated in figures 1 through 11 in this article. The grinding supervisor who is constantly on the alert to pick the right shape wheel for his jobs will be saving money for his company by minimizing the waste of "do it yourself" wheel dressing and shaping.

A large manufacturer had a cylindrical grinding operation on which the O.D. of a shaft was being ground with a 24" x 3½" x 12" Type 1 wheel (Fig. 1). One day the engineering department added a side wall grind to the job. To maintain a small contact area when "bumping" the side wall the machine operator under-cut

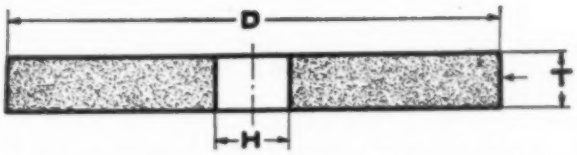


**Fig. 1. A Type 1 wheel, often called a straight or plain wheel. A peripheral grinding wheel having a diameter, thickness and hole. The 24" x 3½" x 12" wheel mentioned in the text has a bigger hole in relation to the outside diameter.**

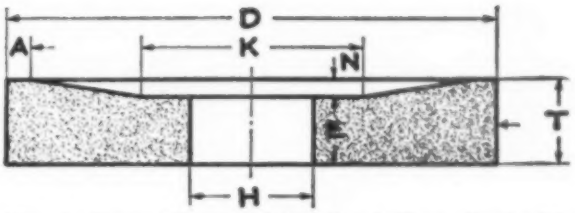


**Fig. 3. Type 20, a peripheral grinding wheel with one side relieved to a flat, the other straight.**

**Fig. 2. A Type 1 wheel with the side undercut.**

**Fig. 4. Type 5, grinding wheel recessed on one side. Recess allows clearance for the nut and flange.**

the side of his grinding wheel with a dressing stick (Dotted Lines Fig. 2.). When the grinding supervisor next requisitioned wheels he specified Type 20 in size 24" x 3½" x 12" tapered in one side for periphery ½" deep to 14½" flat spot. The relieved wheel helped in keeping the small side wall contact (Fig. 3) even though the operator still had to do some under-cutting as the relief flattened out from wheel wear. Observing that the heavy side wall stock removal caused the wheels to lose their width before being worn much on the diameter the grinding supervisor calculated the diameter lost in relation to the width lost and next ordered Type 5 wheels in size 24" x 3½" x 12" recessed one side 21" x 1½". These wheels could be easily undercut (Dotted Lines Fig. 4.) and actually cost less that the Type 21 wheels. Here is an example of how knowing the available shapes brought about clear cut savings in cost and in grinding time.

Another company was using angle head grinders to cylindrically grind the O. D. and the side wall on a motor shaft. They were buying a straight face wheel (A Face) and diamond dressing the face angles until they realized that they could buy their wheels with an "N" face specifying any "V" angle and "X" dimension (Fig. 5.) for only $2.40 more per wheel (based on the brand, size, specification and quantity ordered). The "N" face is the latest addition to the list of grinding wheel faces and everyone using angle head grinders should take advantage of it.

**Use The Simplest Shape That Will Do The Job**

Just as there are some users who are not taking full advantage of the available special shape wheels, there are also users who buy fancier shapes than they need.

The cheapest wheel in any given size is a Type 1 straight wheel. (Fig. 1). Whenever recesses are added to the straight wheel price additions make the wheel more expensive. Two recesses cost more than one recess and the larger the recess diameters, within limits, the higher the cost.

Recesses in grinding wheels serve two purposes. (1) They reduce overhang on wheel spindles. (2) They permit the use of wider wheels on mounts made for thinner cross sections. But wheel users buy recessed wheels unnecessarily for mounts when the simple addition of longer bolts would eliminate one and sometimes two recesses; or sometimes buying recessed wheels simply through force of habit as in the case given below.

A company ordered some Type 5 wheels 24" x 2" x 12" recessed one side 14½" x ½". This company had been using Type 5 wheels in size 24" x 2½" x 12" recessed one side 14½" x ½". When they reduced the thickness of their wheels from 2½" to 2" they automatically ordered Type 5 wheels when Type 1 straight wheels would have been adequate. The grinding foreman in this instance did not know that a recessed wheel cost more than a straight wheel, and the purchasing agent did not know that the recess was unnecessary.

In a more specific application users of hob grinding wheels have for years purchased a special dish wheel 7" in diameter by ⅝" thick similar

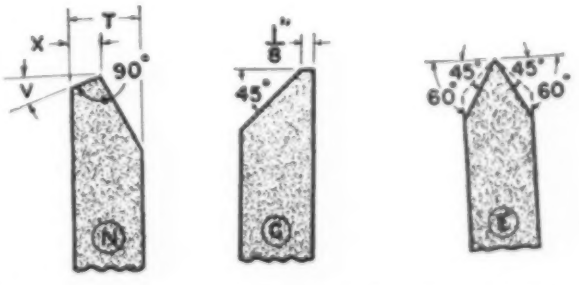


**Fig. 5. Three common standard shapes of grinding wheel faces, N, C and E, which are applied only to Types 1, 5, and 7 wheels. For face N, dimensions V, T, and X are specified by the user.**

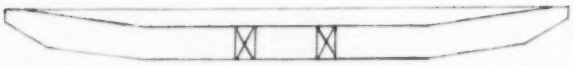

**Fig. 6. Dish wheel, Type 12, used for hob grinding.**

**Fig. 7. A Type 1 wheel with a B face does the same work in hob grinding, is less expensive.**

to the one illustrated in Fig. 6. A large majority of hobs can be ground just as well with a 7" x ⅜" or a 7" x ½" Type 1 wheel have a "B" face (Fig. 7.). Use of this later and simpler shape effects considerable wheel cost savings.

Similarly it is wasteful to use a Type 11 flaring cup wheel when a Type 6 straight cup will do the job (Figs. 8 & 9); or a Type 6 straight cup when a plate mounted wheel will do the job (Figs. 9 & 10); or a plate mounted wheel when a Type 2 cylinder will do the job (Figs. 10 & 11). Any user of Types 2, 5, 6, 7, 11, 12, 20 thru 25, or plate mounted wheels will find it to his advantage to consider whether he really needs the type wheel he is using.

**Specify The Largest Hole (6" or Larger) That Is Safe**

As ordinary grinding wheels become smaller in diameter through wear, their surface speed (sfpm) becomes slower and the arc or area of contact between wheel and work becomes smaller. In "variable density," "tapered structure," or "graduated density" wheels (GRINDING AND FINISHING, December 1957) this condition is minimized, but there comes a time in the life of every wheel, particularly if its original diameter was large and its hole small, where the wheel must be discarded for reasons of efficiency.

Suppose, for example, that you have been using a 20" diameter wheel with a 5" hole and discarding the wheel when the diameter is reduced to 16". If a wheel with a 12" hole is still safe to operate at the minimum diameter, then you have been buying—and wasting—a ring of abrasive 12" in diameter, with a wall thickness of 3½", for every wheel you use.

As another example, steel mill roll shops sometimes employ several different makes of roll grinding machines. Some of these machines were made to take 36" x 4" x 12" wheels while others were made to take 36" x 4" x 20" wheels. Obviously the 36" x 4" x 20" is the cheaper wheel; taking advantage of this fact, some roll shops have made mounts so that they can use 20" hole wheels on all of their machines.

A word of caution. Large hole vitrified bonded wheels cannot be made to incorporate reinforcing rings at stub size. As a consequence large hole vitrified wheels should not be used on any operation where they are subjected to heavy pressure or shock, such as rough snagging jobs.

The larger the hole (over 6"), the cheaper the wheel. Use the largest standard diameter hole that is safe. This may require minor machine modifications but they will soon be paid for.

**Buy The Largest Diameter Wheel Possible**

Every grinding wheel has a maximum safe operating speed which is established by the wheel manufacturer. *Remember that this is not a recommended operating speed for any particular operation, but the maximum speed at which the wheel can be operated safely.* Yet it is generally true that metal can be removed fastest when wheels are operating somewhere near their maxi-

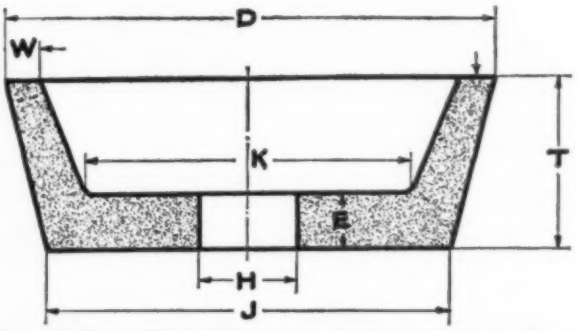


**Fig. 8. Type 11, flaring cup wheel. A wall grinding wheel with the wall flared outward from the back.**

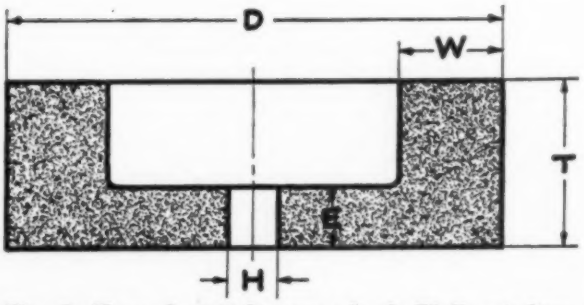


**Fig. 9. Type 6 straight cup wheel. Wall grinding wheel with one side flat, the other side recessed. Differs from Type 5 in that grinding is done on the wall (W) dimension rather than on the periphery.**

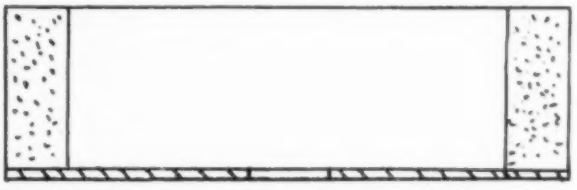

**Fig. 10. Plate-mounted wheel. Wall grinding wheel secured to a plate which is mounted on the machine.**

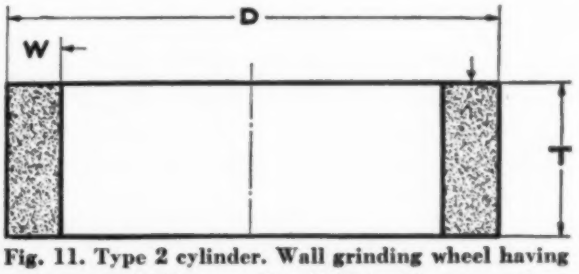


**Fig. 11. Type 2 cylinder. Wall grinding wheel having a diameter thickness and wall. Wheel is mounted on diameter.**

mum operating speed. For that reason it is usually best to buy the largest diameter wheels that can be used safely on any machine. One other factor must be taken into consideration. The Safety Code specifies the largest diameter wheel that may be used on a spindle of a given diameter; these limits must be adhered to.

Although often neglected, the consideration of the right diameter for small internal wheels and mounted points is important from a grinding efficiency standpoint. When grinding in a hole, the original diameter of the grinding wheel or mounted point should be as close as possible to the diameter of the hole being ground.

**Buy Minimum Thickness Wheels**

Here again consideration must be given to the fact that there is a point of minimum safe thickness for any wheel. On plunge cut cylindrical grinding, in-feed centerless operations, and some snagging and off-hand grinding jobs, however, the most economical wheel would probably be one just slightly thicker than the width of the surface to be ground on the piece-part. Thus the entire width of the wheel face would be in use continually. Not only are thinner wheels usually cheaper, but if the wheel is too wide for the surface to be ground, the result will be grooving or uneven wheel wear, causing extra dressing and wasting of otherwise usable abrasive.

From another standpoint, generally speaking, the thicker the wheel the more pressure required to make it cut. Hence, for example, when cylindrically grinding small diameter parts with no steady rest, or when grinding material such as thin wall tubing, reducing the width of contact often improves cutting action.

There are some exceptions to the rule of using minimum thickness wheels. On thru-feed centerless operations where stock removal is heavy, it is sometimes advantageous to increase the width of the wheel. When traversing long parts in cylindrical grinding, increasing the width of the wheel makes "holding size" easier. And on some large surface grind-operations a wider wheel may permit more stock to be removed per pass.

All of these factors should be taken into consideration when arriving at the proper width for a wheel.

**Conclusion**

Selecting the optimum size and shape of wheel benefits the buyer in four ways. First, he gets the most usable abrasive at the lowest price. Second, he uses as much as possible of the abrasive he pays for. Third, by buying standards he gets better service. And finally, he saves dressing time and dressing tools by buying the right shape. Anyone, and particularly any user who has been buying wheels "because we've always bought that size," will find it worthwhile to review his dimensional specifications in the light of the six benchmarks mentioned above. Any user of wheels can effect some economies and may well discover substantial savings similar to those mentioned in the cases above. • • •


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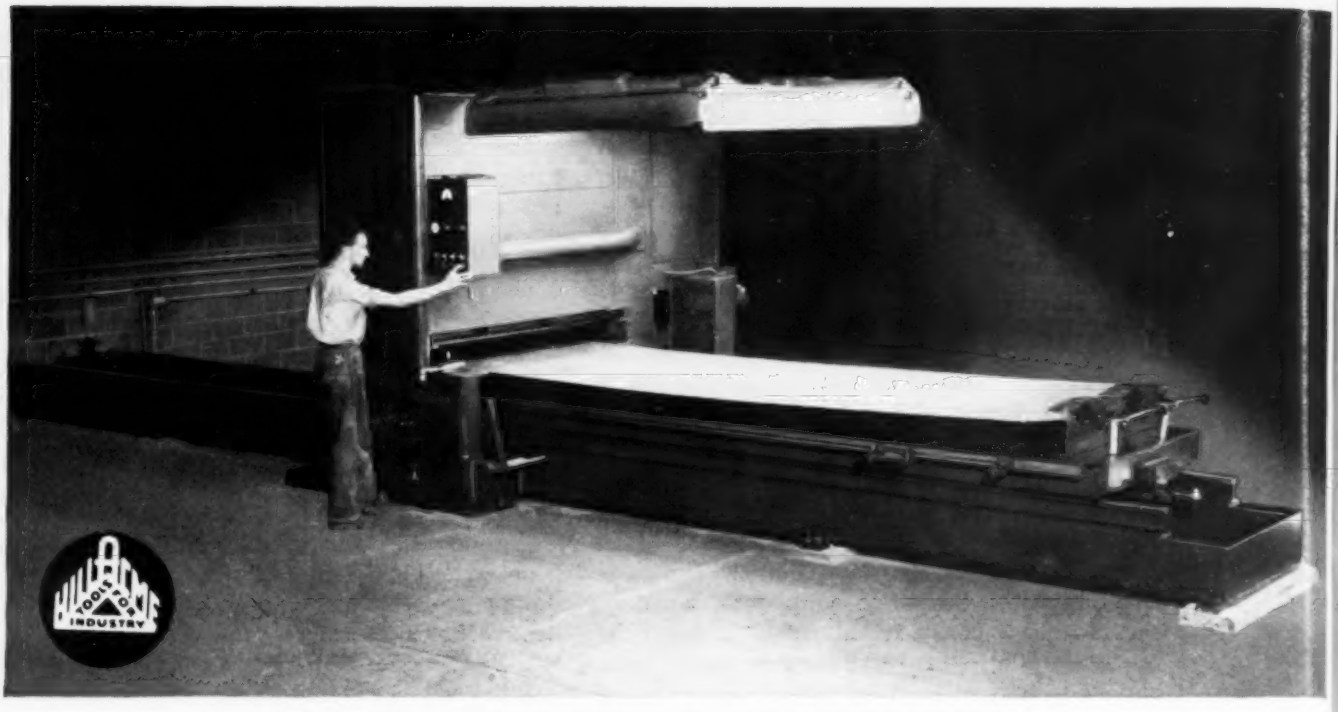

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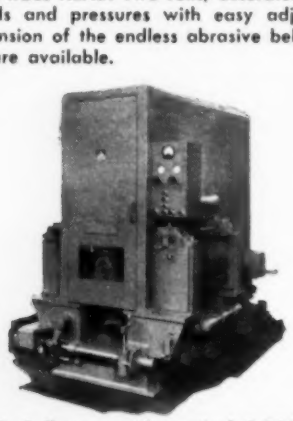

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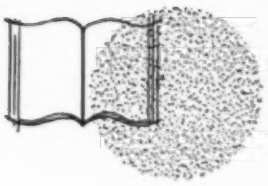


# Literature

**1. Wall Chart of Grinding Do's and Don'ts.** A 13½"x13½" wall chart listing ten do's and don'ts for grinding wheel operator safety is now available free of charge. The information in the chart is based on regulations established by the American Standard Safety Code for The Use, Care and Protection of Abrasive Wheels, B7.1-1956. This wall chart is suitable for display in tool rooms, on bulletin boards and in grinding machine area. It is printed in two colors on cardboard stock. Grinding Wheel Institute, Cleveland, Ohio.

Grinding wheels are safe...use but don't abuse
DO
1 DO always HANDLE AND STORE wheels in a CAREFUL manner.
2 DO VISUALLY INSPECT all wheels before mounting for possible damage in transit.
3 DO CHECK MAXIMUM OPERATING SPEED established for wheel against machine speed.
4 DO CHECK MOUNTING FLANGES for equal and correct diameter. (Should be at least ⅓ diameter of the wheel and relieved around hole.)
5 DO USE MOUNTING BLOTTERS supplied with wheels.
6 DO be sure WORK REST is properly adjusted. (Center of wheel or above, no more than ⅛" away from wheel.)
7 DO always USE A GUARD covering at least one-half of the grinding wheel.
8 DO allow NEWLY MOUNTED WHEELS to run at operating speed, with guard in place, for at least one minute before grinding.
9 DO always WEAR SAFETY GLASSES or some type of eye protection when grinding.
10 DO TURN OFF COOLANT before stopping wheel to avoid creating an out-of-balance condition.
DON'T
1 DON'T use a wheel that HAS BEEN DROPPED.
2 DON'T FORCE a wheel onto the machine OR ALTER the size of the mounting hole—if wheel won't fit the machine, get one that will.
3 DON'T ever EXCEED MAXIMUM OPERATING SPEED established for the wheel.
4 DON'T use mounting flanges on which the bearing surfaces ARE NOT CLEAN AND FLAT.
5 DON'T TIGHTEN the mounting nut EXCESSIVELY.
6 DON'T grind on the SIDE OF THE WHEEL unless wheel is specifically designed for that purpose.
7 DON'T start the machine until the WHEEL GUARD IS IN PLACE.
8 DON'T JAM work into the wheel.
9 DON'T STAND DIRECTLY IN FRONT of a grinding wheel whenever a grinder is started.
10 DON'T grind material for which the WHEEL IS NOT DESIGNED.

(See Number 1)

**2. Snagging Wheels.** A new general catalog, "Cincinnati Snagging Wheels (PG-356), describes the features and proper selection of these wheels for swing frame, floor stand and portable grinding. It also includes a section on grinding operation costs, another on safety practices with snagging wheels, and a complete table of starting grades for rough grinding operations. Cincinnati Milling Products Division, Cincinnati Milling Machine Company, Cincinnati, Ohio.

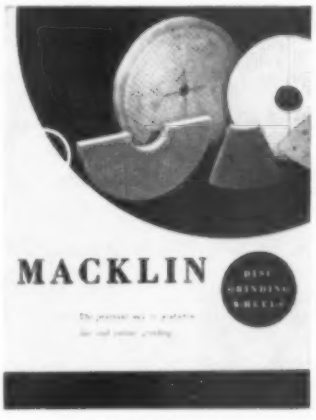
**3. Barrel Finishing.** Twenty-one case studies of parts whose finishing costs have been reduced by a change to barrel finishing are included in this 16-page brochure. While most of the applications cited are of relatively small or medium-sized piece-parts, irregularly shaped, some larger parts are also included. Suggestions for media and compounds complete the booklet. Minnesota Mining and Manufacturing Company, St. Paul, Minnesota.

**4. Gaging Newsette.** The November issue of this flier, "issued from time to time to tell you of some of the goings-on in gaging," features descriptive material about a new adjustable form and groove gage and a retractable contact unit for use with No. 1 or No. 2 size AGD indicators. Standard Gage Company, Inc., Poughkeepsie, N.Y.

**5. Grinding Wheel Treatment.** Four-page, two-color folder describing the application and benefits of treating grinding wheels with synthetic colloidal graphite in particle sizes ranging from 1/125 to 1/100 micron. Marketed under the trade name of "Dri-Kool," the material is said to improve the heat conductivity of the wheel, reducing temperatures at the grinding surface. Methods of treating wheels are discussed, and a number of successful applications are described. King Graphite Products, Inc., Trenton, Michigan.

**6. Disc Grinding Wheels.** A new four-page color brochure on disc grinding wheels describes the desired characteristics of these wheels and provides performance records on various disc grinding operations.

The literature is illustrated with photographs of various sizes and types of disc wheels, including perforated-slotted multiple graded disc wheels. Wheel recommendations for cutting a wide range of materials are also included. The Macklin Company, Jackson, Michigan.




(See Number 6)

To obtain literature use Reader Service cards on page 49. Circle on the card the number which appears at the start of the paragraph describing the literature you request.

**7. Semi-Conductor Slicing Machine.** New literature describes the operation and applications of the new Microtom-atic® slicing machine model MTA-7. Using diamond wheels, the machine produces thin, accurate slices of brittle materials at high and sustained production rates. Applications for this slicing machine in electronics are recognized, and potential uses

## FREE LITERATURE *continued*

such as the slicing of quartz, barium titinate, aluminum oxide, lead zirconite and honing stones, among others, are described. The DoALL Company, Des Plaines, Illinois.

**8. Cutting Trends.** Volume 2, No. 2 of this reference sheet on grinding wheels and machine knives for metalworking, wood, paper and allied industries features an article on the reduction of rejects through proper balancing of grinding wheels and grinding machines. The article discusses the meaning of unbalance and describes electronic procedures for locating and correcting unbalanced parts in rotating machinery. Also included is a column listing current technical bulletins on grinding and cutting techniques. Simonds-Worden-White Co., Dayton, Ohio.

**9. Micrometers.** A new four-page three-color bulletin, No. 24, fully illustrating representative groupings of the complete line of Slocomb micrometers is now available. Pricing information is provided on a separate insert sheet. Examples of standard micrometer calipers ranging from 1" through 60" are shown along with illustrations of many special micrometers, including the snap gage, air foil, sheet meta and others. Covered in the new catalo is the "Speed-mike," Slocomb's direc reading micrometer. J. T. Slocomb Com pany, South Glastonbury, Connecticut.

(See Number 9)

**10. Metal Cleaning.** A comprehensive treatment of the subject of the cleaning of the approximately fifty metals in industrial use today is this 24-page pamphlet. The introduction points out that substances which are desirable at one stage of metal processing become soil or dirt in later stages, necessitating a cleaning operation. Buffing compounds, coolants, metal chips and abrasive particles are some of the many substances that may be removed. The booklet is thumb-indexed for easy reference. Oakite Products, Inc., New York, N.Y.

**11. Dry Abrasive Cutting Machine.** A recent four-page folder describes the Model 2-A dry abrasive cutting machine. Illustrated with both general and close-up views of the machine, the literature also points up the advantages of abrasive cutting. Standard specifications of the model 2-A Sever-All are also presented. A variety of work holders which add to the versatility of the machine are shown. Allison-Campbell Division, American Chain & Cable Company, Inc., Bridgeport, Connecticut.

(See Number 11)

**12. Self-Opening Centrifugal Separator.** A bulletin describing a new line of self-opening centrifugal separators has recently been issued. Designated as the De Laval Model PX line, the machines are designed for continuous processing of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*For 1¢ a gallon of coolant,* you get the most open grinding wheel you'll ever see, with W&B Grinding Concentrate 1500 — unusually keen grinding action. White & Bagley's 1500 is a chemical type water soluble that mixes instantly with water. It forms a light-green, transparent, non-irritating solution that stays sweet and clear. Use it for exceptional accuracy, high production, on *steel and titanium.*

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To get superior results on *both grinding and cutting,* use W&B Lubricant 1888. This oil-type, water soluble concentrate with high-detergent action mixes easily with any water — forms a stable translucent emulsion that gives more support to wheels and cutting tools. You get smoother finishes, and closer tolerances with White & Bagley's 1888. It's non-irritating, free from offensive odors; keeps machines clean.

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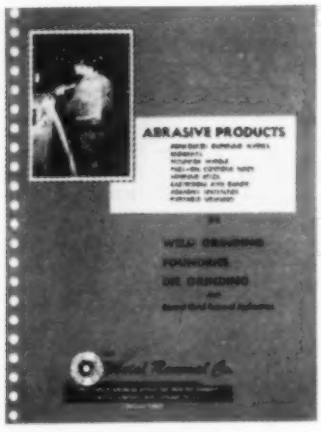
liquid mixtures having high solids content. The bulletin (S.A1129-8-59) features photographs, specifications and dimensions of the equipment. Also included are diagrams of a typical unit in open and closed positions; special design features, and a list of industries where it is most applicable. The De Laval Separator Company, Industrial Division, Poughkeepsie, New York.

13. **Rotary Tool Accessories.** This 42-page catalog of abrasive and related products is detailed and informative. Of particular interest are the sections on mounted wheels, small wheels for portable grinders and their unusual line of portable air grinders. Metal Removal Co., Chicago, Illinois.




(See Number 13)

14. **Data File Folder—Tumbling.** A file folder containing descriptive bulletins about barrel finishing equipment and process bulletins for their application to various materials, along with recommendations for compounds and media, is now available. The latest equipment bulletin describes the Tumb-L-Matic Type XLC barrel finishing unit, with specifications for the various models. Pre-filed bulletins provide easy and complete data on tumbling equipment available. Tumb-L-Matic, Inc., Stamford, Connecticut.

15. **Steel Blast Cleaning Abrasives.** Booklet No. 2294 outlines the important factors to be considered in the selection of steel blast cleaning abrasives. A 20-page publication, non-technical in style, it describes the latest metallurgical developments applied in the production of steel shot. Features which make one kind of abrasive better than another are graphically presented. A section is devoted to the methods of quality control. Also included is a list of the results obtained by companies testing blast cleaning abrasives. Pangborn Corporation, Hagerstown, Maryland.

16. **Lightweight Portable Comparator.** Full particulars concerning physical specifications and the four AGD dial gage sizes, capacities and ranges for the new Model B2 portable comparator. The flier, just released, shows the instrument in two positions, one with the angle support leg extended to tilt it 20° for comfortable, parallax-free viewing, and the other with the support folded into the base. Also shown is the Em-re dial indicator. Petz-Emery, Inc., Pleasant Valley, N.Y.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# WHY MICROHONING* of Valve Tappet Bores Assures Economical Production, Precision and Functional Surfaces

Johnson Products, Inc., (Muskegon, Michigan) is a pioneer in the manufacturing of hydraulic valve tappets. Placing strong emphasis on quality control, they demand consistent precision and geometric accuracy. Here's why Johnson engineers insist on using the Microhoning process.

*Typical Johnson valve tappet — cross section shows interrupted, semi-blind-end bore.*

## Generates Clean-Cut Surfaces

Microhoning is a low-velocity abrading process that uses a combination of controlled speeds, feeds and motions to provide functional surfaces. Also, the large area of contact between abrasive and work surface spreads and easily dissipates the cutting heat. Thus, Microhoning generates clean-cut work surfaces that are free of burned or smeared metal.

## Produces Longer-Wearing Surfaces

Because the Microhoned surface is cleared of amorphous material, it is in the base metal zone where longer-wear characteristics are more readily induced. Also, the unique Microhoning cross-hatch lay pattern provides a multitude of minute "plateaus" for equitable distribution of work load.

*Two of the double-spindle Hydrohoners, each spindle has its own sizing control.*

## Functional Accuracy

Geometric accuracy is mandatory! For, there must be a clearance of .0002"-.0003" between tappet bore and its plunger. Microhoning consistently holds bores within the .00003" tolerance for roundness and straightness, and within .0005" for size. Proof—each tappet assembly must pass a critical "leak-down" test.

## Processing Economy

In a typical production run of 31,250 parts, scrap was only three-tenths of 1%. This is a striking example of economy resulting from consistent quality processing. The use of Microhoning also eliminated previously required precision boring — several boring machines were involved in this saving.

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## FREE LITERATURE *continued*

**17. Optical Grinding and Polishing.** A new catalog and price list for stock and custom transparent quartz prisms, slides, insulators and special shapes used in industrial and scientific fields is now available. The catalog carries information about Esco facilities for ID and OD grinding and surfacing, as well as graphs showing transmission characteristics of quartz and various glasses, optics of fused quartz and charts of the inherent qualities of the material. Esco Products, Inc., Oak Ridge, New Jersey.

**18. New Ordering System— Mounted Wheels.** A new plan for ordering mounted wheels, effective January 30, 1960, will bring immediate delivery for 90% of all mounted wheel orders, according to Bulletin SS-101, Chicago Wheel & Mfg. Co. Basis of the system is research by the manufacturer, which disclosed that six special shapes, in twenty-seven sizes would cover nine-tenths of all portable grinding needs for mounted wheels, given a choice of specifications. By simplifying the number of wheels, Chicago Wheel and its distributors are able to maintain a complete standing inventory of the SS Series (Special Shapes) mounted wheels available for immediate shipment from stock. There is no increase in price for this service. In addition to the new SS Series mounted wheels, Chicago Wheel offers over 100 standand mounted wheels on regular order. Chicago Wheel & Mfg. Co., Chicago, Illinois.

(See Number 18)

**19. Safe Wet Magnetic Particle Inspection.** A new 36-page booklet describes wet magnetic particle inspection using Inmunol 438 in water as the vehicle for oil soluble and water soluble inspection pastes instead of kerosene or other solvents. The method is said to provide better definition of flaw, cost reduction and the elimination of fire and other hazards. Numerous case histories are cited. Harry Miller Corp., Philadelphia, Penna.

**20. Tangent-Arc Profile Grinder.** Two-color folder describes the Hartex line of tool and cutter grinders, featuring the

No. 3 tangent-arc profile grinder. This machine is designed for sharpening cutting tools having radii in the cutting surface and for grinding clearances on profile type, straight or angular cutters. The grinder can accommodate arbor type cutters up to 10" in diameter and taper shank mills up to 12" overall length. Union Twist Drill Co., Athol, Mass.

**21. Diamond Coated Saws and Tools.** Eight-page black and white brochure describes various diamond-coated tools for machining and cutting glass based plastics. Considerable general data of interest to potential users is included, along with illustrations of various applications of cutting and grinding operations on differing kinds of fiberglas and similar materials. Descriptions and specifications for diamond coated saw blades, mounted wheels, hole saws, milling wheels and routing wheels are given. O'Rourke Diamond Company, North Hollywood, Calif.

**22. Steel Abrasive Performance Data.** Performance and statistical data compiled in extensive abrasive research and experimentation are revealed for the first time in a new Handbook of Blast Cleaning Abrasive Performance, Bulletin 903-D. Topics discussed include the relationship of performance and economy; how abrasive breakdown characteristics affect finishes and costs; the effect of abrasive hardness on cleaning speed; abrasive size and finish quality; controlling finish achieved by airless blast cleaning. Charts and graphs illustrate the effect of abrasive size mixture, shot consumption averages, the per cent of wheel efficiency at which blast equipment is operating and the relationship of abrasive price and consumption to actual costs. Wheelabrator Corporation, 1169 South Byrkit Street, Mishawaka, Indiana.

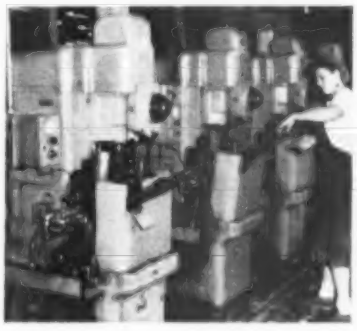
(See Number 21)

**23. Micro Hardness Tester Bulletin.** A new two-color, four-page folder describing Kentron micro hardness testers has just been announced. These instruments apply dead weight loads from 1 to 1000 grams, with additional weights for applying heavier loads up to 10,000 grams available as optional equipment. Two sizes are offered. Model AK has a vertical capacity of 2½", is primarily a research instrument. Model AK 8, with a vertical capacity of 8", is basically a production control instrument, though it has the same accuracy as the smaller instrument. Photographs and detailed descriptions of ten basic accessories are also included in the bulletin. Torsion Balance Company, Clifton, New Jersey.


# HOW MICROHONING of Valve Tappet Bores Generates Accuracy Within .00003", Eliminates Boring, Cuts Scrap Losses

To obtain functional surface qualities, engineers at Johnson Products, Inc. are insisting on Microhoning the bores of hydraulic valve tappets designed for long service or punishing usage. In addition, here is how Microhoning also generates consistently high accuracy, eliminates an extra operation and reduces scrap losses to a minimum.

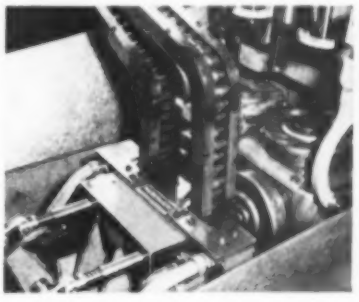
## Automatic, Consistent Precision



Pictured is a line of four Model 738 Microhoners that typify the Microhoning equipment used by Johnson Products. Each machine has: automatic stonefeed and stonewear compensation (Microdial); automatic sizing unit (Gage Ring Air-Switch Microsize); air operated raising and lowering of fixture table assembly is synchronized with head controls for automatic operation.

*Result:* Johnson automatically obtains consistent precision as evidenced by these several facts. Microhoned bores are held within .00003" tolerance for roundness and straightness, within .0005" for size, and a specified surface finish of 12-14 microinches (rms) is generated. Also, from a typical production run of 31,250 parts, only three-tenths of 1% was scrap—a striking example of processing control and low scrap loss.

## Flexible and Efficient Processing



Bore diameters of Microhoned tappets range from .656" to .800", and lengths from 1" to 2". Material is either cast iron, or iron alloy hardened to 55-60 R "C". In all, 15 different combinations of sizes and materials are Microhoned. Typical fixturing is shown to the right—it is designed to keep changeover time at a minimum.

From .004" to .005" stock is removed during the Microhoning cycle of 18 to 21 seconds. Cutting efficiency is boosted by the design of special Micromold tools. Intraflow features (within the tools) supply coolant directly to cutting zone.

*We will gladly send more information on the Microhoning process and equipment—*
*WRITE FOR FREE LITERATURE*

**MICROMATIC HONE CORP.**
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

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# Always . . .

# ON THE SPOT!

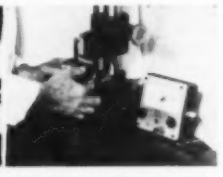
Here is a fast, accurate gage that has a hundred uses. It can be used at the machine, in production, in the inspection department . . . and in the gage laboratory.

Simple to use, it requires no special skill on the part of your personnel. It weighs only 3 lbs.

*MICROtrol* *170 transistorized gaging system, which includes a battery-powered amplifier and four types of interchangeable gage heads, is for use with production comparators, height gages, snap gages, ID or OD gages and similar bench inspection devices.

INDICATOR GAGE HEAD used with standard height gage-stand for surface plate work.

AGD GAGE HEAD used with snap gage for production line inspection.



FRICTIONLESS GAGE HEAD used with comparator stand to check production parts.

## Features

- *Only 2 control knobs*
- *One adjustment zeros both scales*
- *Large meter with 4.6" scale*
- *Dual range—from either ± .0003" to ± .003" or ± .001" to ± .010"*
- *Accurate—transistorized throughout*
- *Pocket-sized—5¾" square by 3⅛"*
- *Mounting adapters and gage head stored in cover*
- *Carrying case handle doubles as amplifier stand*
- *Lightweight—weighs only 3 lbs.*
- *Battery powered—can be used anywhere*
- *AA dry cells can be used in emergency*

Basic Gages start at $341.00

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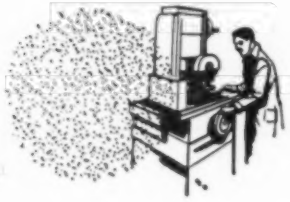

# Equipment and Materials

### Surface Finish Recorder

The new Proficorder® is a mechanical-electronic instrument which provides a permanent, magnified chart record of the shape, height and spacing of surface irregularities, including pits, flaws, waves, roundness, waviness, roughness and total profiles.

The differential transformer type transducer transforms the physical displacements of the stylus into electrical charges which are translated onto graph paper for study and permanent record keeping. The diamond stylus of suitable tip radius rides lightly on the work being measured. Tracing range on OD's is from 1/32" to 8". On ID's the range is from ⅛" to 8".

Both linear and rotary Proficorders are available, as illustrated. They can be purchased separately, but significant savings can be realized by buying them in combination.

Micrometrical Manufacturing Co., Ann Arbor, Michigan.

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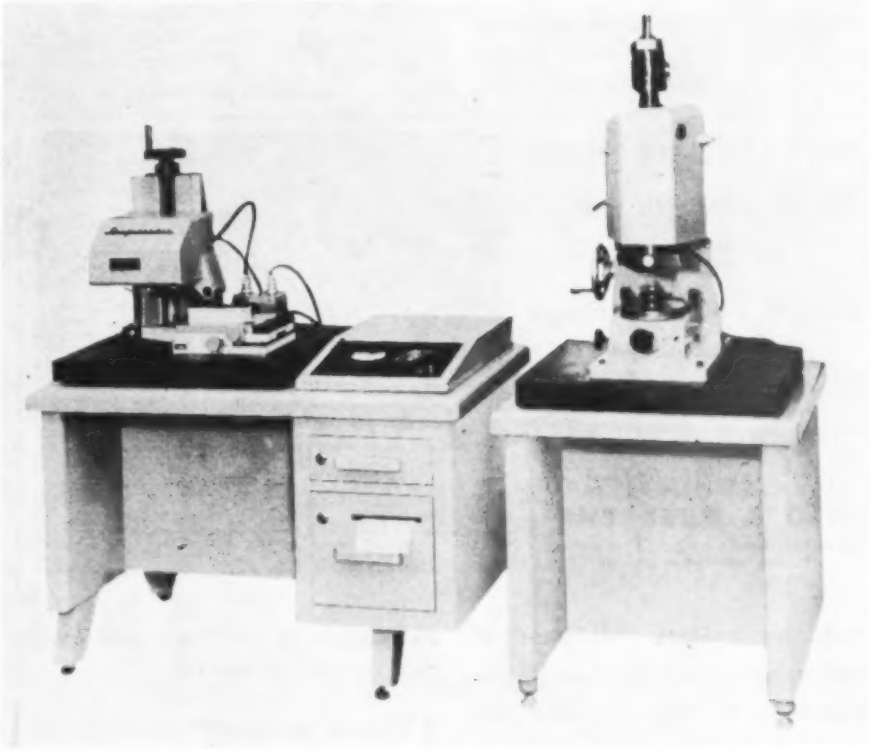


### Surface Grinder for Form Grinding, Other Toolroom Uses

Micromatic's new model 1400 surface grinder has all the best features of their smaller and established model 540, but is of larger capacity and includes additional features. Model 1400 is most suitable for form grinding and other toolroom uses.

The table working surface is 24" x 7". Maximum cross traverse of the table is 8", and longitudinal traverse 25". Table traverse speed is variable from 10 to 60 fpm.

Cross-feed range per stroke at each reversal ranges from .007" to .070". Wheelhead and cross-feed are adjustable in increments of .00001".

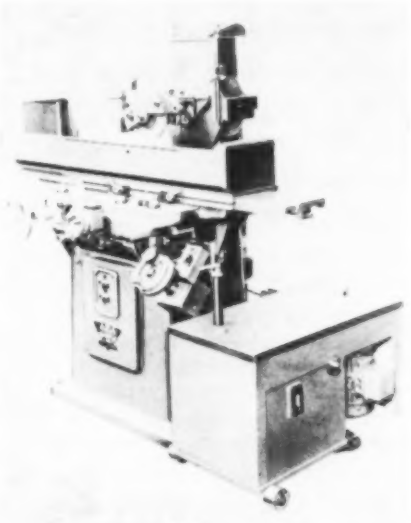


Table reversal at all speeds is shockless. The separate hydraulic pump is isolated from the machine to prevent vibration. The nitralloy wheel spindle runs in plain bearings, while the saddle is mounted on ball-bearing slides.

Standard equipment furnished with the grinder includes two grinding wheels, flange plates, wheel balancing mandrel, truing attachment, etc.

Extras such as an optical dividing head, wheel forming attachments, form grinding equipment, etc., are available to provide for full utilization of the machine.

Micromatic Hone Corporation, Detroit, Michigan.

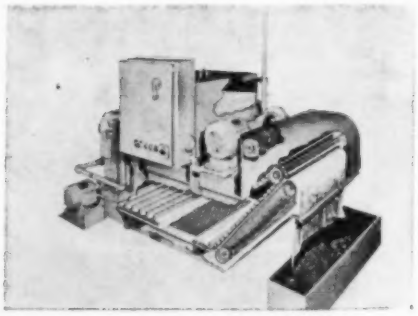
Use postpaid card. Circle No. 25

### Automation In Filtration

The new Hydro-Vac filter is a completely automatic unit designed to operate with pressure and vacuum on the media, and the lowest possible liquid inlet height.

This was accomplished by designing a filter in which the media travels on the bottom of a settling tank and above a vacuum box. Dirty coolant returning from the machines enters the filter approximately 18" above the floor.

The dirt-laden liquid passes downward to the filter media where all contaminants are removed. Dirt remains on



the media, and the clean liquid passes to the suction of the filter pump.

The coolant then can be pumped either directly to the machine or to a clean coolant reservoir.

When the media is completely contaminated a scraper conveyor discharges the sludge into a hopper.

Hydromation Filter Company, Detroit, Michigan.

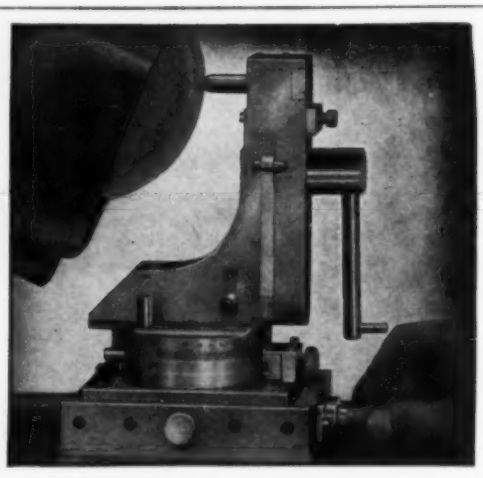
Use postpaid card. Circle No. 26


**Tough Grinding Wheel Forms Dressed Easy as A, B, C**

**eliminate elaborate set-ups and operations**

**.0001" ACCURACY**

*Fluidmotion*
**WHEEL DRESSERS**
dress two angles tangent to a radius in one continuous motion



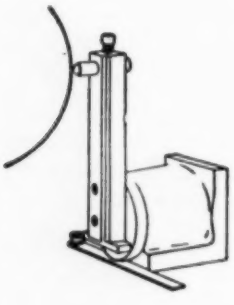
**With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.**

**Adaptable to all type cylindrical and surface grinders.**

**A. Obtain micrometer reading; add required convex radius or subtract required concave radius.**

**B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.**

**C. Tighten jib. Set stops for two angles. Ready for action.**



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

J&S TOOL CO., INC. — CLAMPCUT

880 DORSA AVE.
LIVINGSTON, NEW JERSEY

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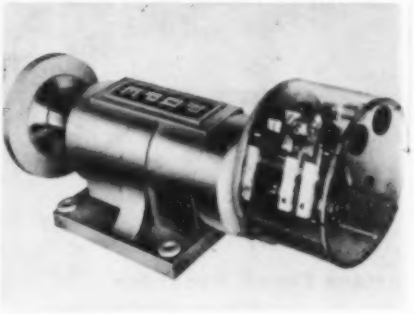
### Precision Spindles for Electrically-Aided Grinding

Precision spindles for electrically-aided grinding are available in a range from 1 to 20 hp, with speeds of 900, 1200, 1800 or 3600 rpm. Either motor or belt-driven, they can be supplied to operate on current from 50 to 3000 amperes.



These Pope spindles have built-in insulation and are equipped with a new and rugged fork type, cool-operating brush assembly for transmitting low-voltage current to the grinding wheel.

Pope Machinery Corporation, Haverhill, Massachusetts.

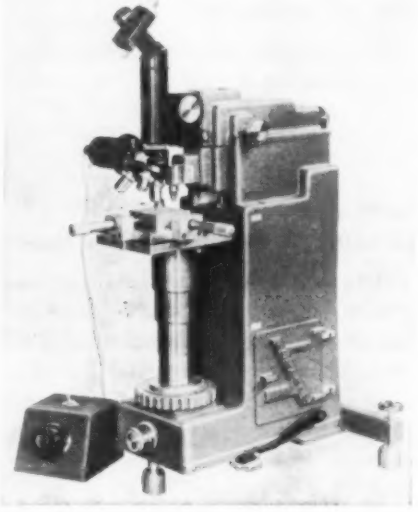
Use postpaid card. Circle No. 27

### New Micro Hardness Tester

A new micro hardness tester, with a vertical capacity of 8", has recently been announced.

The Kentron Model AK 8 applies dead weight loads from 1 to 1000 grams. Additional weights for loads up to 10,000 grams can be furnished as extra equipment.

This is basically a production control instrument, but has the same accuracy



as the model AK, which is a standard research instrument used in metallurgical laboratories.

This new 8" micro hardness tester is specially designed to test unmounted

parts so they can be returned to production or the stock bin.

It can also be used to test mounted specimens, small parts, sheet metal and wire, as well as similar items,

Torsion Balance Company, Clifton, New Jersey.

Use postpaid card. Circle No. 28

### Micrometer Calipers with Blade-Type Anvils, Spindles

A line of micrometer calipers with blade-type anvils and spindles, Starrett's No. 486 series, is now available. These newly-designed micrometers have been planned to facilitate measuring depths of narrow grooves, slots, keyways or recesses, for measuring diameters between lands, fins or ridges, as on circular forming tools.

The blade type anvil and spindle is only .030" thick and will measure depths

up to 5/16". The spindle is non-rotating and will not turn in a slot nor roll off a narrow shoulder.

These instruments are available in five sizes: 0"-1", 1"-2", 1½"-2½", 2½"-3½" and 3½"-4½". All are graduated to read in thousandths of an inch, with every thousandth numbered for quick reading.

A convenient "speeder" on the end of the thimble permits rapid turning of the thimble for fast adjustment.

The L. S. Starrett Company, Athol, Massachusetts.

Use postpaid card. Circle No. 29

### Inflated Sanding Drum for Floor-Mounted Sanders

A new inflated sanding drum, for use with coated abrasive bands on floor-stand machines, has recently been announced. Called the Model 890 Valcore, in metalworking, woodworking and shoe manufacturing.

Built like a low-pressure tubeless tire, the drum is 8" in diameter and takes an abrasive band 9" wide.

Resilience of the air-inflated-rubber contact drum is said to allow the abra-


# NEW TORIT DIAMOND DUST COLLECTOR SAVES YOU UP TO 30% OF CARAT USAGE; COSTS ONLY $178.50!

Dust from these diamond wheels . . .

was recovered by this Torit Diamond Dust Collector . . .

at the rate of 50.5 carats in 14 days.

*exclusive new centrifugal design simplifies recovery, serves all diamond grinding operations*

**Actually pays for itself in days.** In an on-the-job test of this new TORIT equipment, the initial investment was returned in just 21 operating days. The test was conducted by a leading automobile manufacturer under regular operating conditions. Recovery averaged 30% of the carats originally contained in the diamond grinding wheels. You actually get a cash return of $1.00 for every $10.00 invested in diamond grinding wheels.

**For all diamond grinding operations.** This new TORIT Collector provides the same outstanding performance in all types of grinding operations—mist, wick or dry. Its design and operational simplicity also mean virtually maintenance-free service. Its tough construction assures long, long life.

**Installs anywhere.** TORIT'S new Diamond Dust Collector can be used alone or in conjunction with central exhaust systems or unit dust collectors. It weighs only 65 lbs. and requires only 14" x 22" floor space. Its centrifugal separating action uses no filters or sloppy, inflammable oil baths. Service is quickly and conveniently performed by simply unscrewing the unit's top for removal and emptying of the clear plastic container.

**FREE details and full specifications on request.** Here's your chance to really save on your diamond usage. Write today for full information on this important new diamond grinding development. Dept. 510

**TORIT MANUFACTURING COMPANY** 1133 Rankin Street, St. Paul 16, Minnesota

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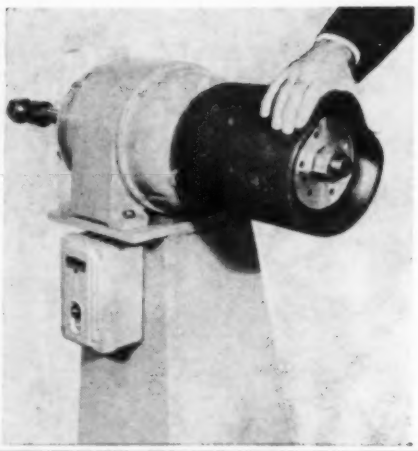


sive to follow contours and to present more abrasive to the work. No part of the core or side plates extends above the abrasive, providing an unrestricted working area across the entire abrasive surface.

The new drum is leak-proof, constructed to rigid safety specifications and requires no adhesive to fasten the drum to the core. All parts are replaceable. Standard bore size is 1¼", with larger sizes available.

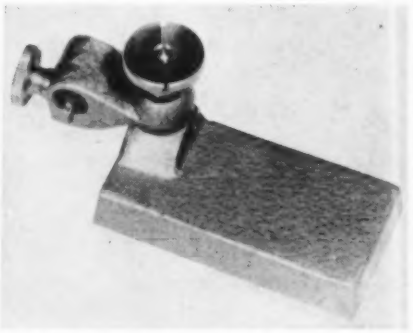
Usual operating speed is 1800 rpm, with 1200 rpm machines also available. Machines may be equipped with single or double spindles.

Nu-Matic Grinders, Inc., Cleveland, Ohio.

Use postpaid card. Circle No. 30

### Magnetic Dial Indicator Holder

A new magnetic dial indicator holder, said to be unique in the field, is now being marketed under the name of "Magna-Holder." The device magnetically attaches itself to any flat machine surface or to angle plates. Once attached, a swiveling clamp permits angular adjustments of the indicator to working position. It is said that the



device does not creep during mounting as a result of machine vibration; yet it is easy to break magnetic contact and remove the holder.

The adjustable clamp of the holder accommodates various dial indicator shanks by means of interchanageable sleeves.

Mueller Gages Co., division of Mueller Laboratory, Pasadena, Calif.

Use postpaid card. Circle No. 31

### Air Die Grinder Delivers up to 25,000 Controllable RPM's

A new Model 1600 air die grinder has a metering trigger that delivers up to 25,000 rpm which lets the operator "throttle down" for feather edging.

The grinder is recommended for polishing, wire brushing and metal removal on dies, stampings, gear teeth, tubes, plastics, castings and weldments.

Wheel capacity is 1¼" vitrified and 1½" organic. The grinder takes standard rotary files, standard or carbide wheels, wire brushes, mounted wheels and sanding drums.

Air consumption of 6 cfm @ 90 psi is said to be half that of a conventional unit. Weight is 15 oz., length, 6". Two

"Do you know that a SPEEDLAP
removes material from a flat surface
faster than most grinders and
accurate within millionths of an inch?"
Address SPEEDLAP CORPORATION
8022 N. Monticello Ave., Skokie, Ill.

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collets are furnished: a ¼" machined on the shaft for minimum "run-out" and a ⅛" that slips into the ¼" collet body. Price complete, $89.50.

Superior Pneumatic and Mfg., Inc., Cleveland, Ohio.

Use postpaid card. Circle No. 32

### Improved Vibratron Eliminates Manual Loading, Unloading

A new and improved model of the Roto-Finish Vibratron which eliminates the need for manual loading and unloading of parts and media has recently been announced.

A built-in, removable double-decked vibrating separator in the base of the machine separates parts and media, as well as fragments from the media, in one simple operation.

The machine can be hopper-fed, and the new design permits discharge of

finished parts into a conveyor on which they move to the next operation.

Primarily designed to finish complex cast, forged, stamped and machined parts with hard-to-reach shielded and internal surfaces, the machine utilizes very short time cycles. With automatic discharge onto a conveyor, the new model Vibratron may fit into a production line. Compact design conserves floor space.

Roto-Finish Company, Kalamazoo, Michigan.

Use postpaid card. Circle No. 33

### New Safety Spectacle Cuts Overhead Glare

The elimination of overhead glare makes the "Eyeshade Spec" suitable for eye protection where overhead lighting creates additional problems.

**can be just as important to you!**

*Your* life line . . . the single thing that keeps your plant operating at a profit . . . is efficient and continuous production. Your profits, employee morale, plant-community relations . . . all can be seriously threatened by inadequate dust or fume control.

KIRK & BLUM, for over 45 years, have been specialists in designing, fabricating and installing dust and fume control systems. From the time engineers arrive to consult, to the moment skilled erectors leave . . . your work is in the hands of one experienced, reliable organization.

Write The Kirk & Blum Mfg. Co., 3124 Forrer Street, Cincinnati 9, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

**KIRK AND BLUM**

**DUST AND FUME CONTROL**

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The design is planned to shade the eyes from above, while the one-piece optical plastic lens gives protection from impact.

Both the regular and sideshield models have one-piece lenses which can be easily replaced without tools. Lenses for both types are furnished in clear or medium green.

United States Safety Service Co., Kansas City, Missouri.

Use postpaid card. Circle No. 34

## New Line of Precision Spindles

DoAll has announced the first of a new line of precision spindles said to possess a tremendous design margin of safety to assure great accuracy throughout their service life. To fulfill the needs of most original equipment manufacturers and replacement users, three models are available.

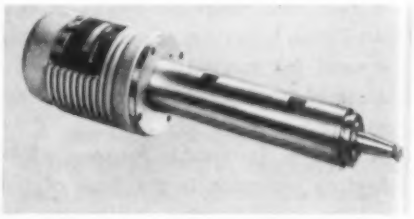
The MD-6 is a 3" OD spindle with integral 1 hp, 3450 rpm motor. Angular contact ball bearings are used and mounted in two preloaded pairs.

Labyrinth type spinner rings on both ends keep foreign matter out of the spindle. The motor is of the lowest temperature rise type, and is totally enclosed in a finned aluminum housing for efficient heat dissipation.

The MD-7 is similar to the MD-6, but uses a 1½ hp motor.

The BD3-4 is also similar, except that it is belt driven for speeds up to 5000 rpm.

Although all three are heavy-duty type, using double row bearings, they are no larger than standard spindles and may be used interchangeably with them. The motorized spindles operate



at 3450 rpm and are recommended for wheel sizes up to 7" x ½" x 1¼", or 8" for wheels in resinoid or other bonds rated for higher peripheral speeds.

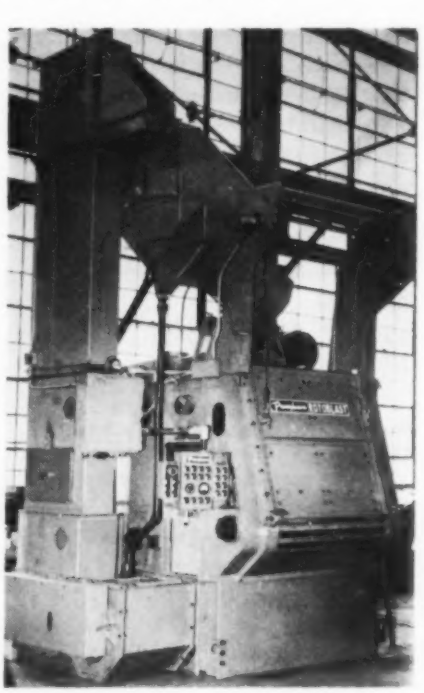
The belt-driven spindle can carry even larger wheels with the belt pulleys arranged for the proper rpm, or smaller wheels up to 5000 pm.

The DoAll Company, Des Plaines, Ill.

Use postpaid card. Circle No. 35

## Heavy-Duty Blast Cleaning Barrel

A recently-introduced 15 cu. ft. Roto-blast barrel is designed to provide the first heavy-duty type barrel of medium size to clean large castings weighing up to 500 lbs. each. The unit will handle a batch load of 2700 lbs.



Available with standard controls or in semi- or complete automation, the machine includes a 30-hp. Rotoblast wheel which delivers 50,000 lbs. of abrasive per hour.

Hammond
AUTOMATICS
cut
GRINDING · POLISHING ·
BUFFING · DEBURRING ·
costs

Your finishing problems can be solved by the proper application of Hammond Automatic or Semi-Automatic equipment. Standard heads, turrets and conveyors are used wherever possible to keep costs down. Special machines are designed for the unusual job.

SEND SAMPLES FOR COMPLETE ENGINEERING REPORT.

Hammond Machinery Builders INC.
1651 DOUGLAS AVE. • KALAMAZOO, MICH.

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A rugged, close-fitting slat-type work conveyor incorporates new design refinements said to make it virtually jam-proof and quiet running. Conveyor tension is quickly and easily adjusted from outside without dismantling or unloading. An automatic torque arm disengages the shaft-mounted reducer drive in case of jams, stopping the work conveyor until the jam is cleared and the torque arm manually re-engaged.

Pangborn Corporation, Hagerstown, Maryland.

Use postpaid card. Circle No. 36

### 72" Vernier Height Gage

Oversize vernier height gages 60" and 72" high are available on special order from L. S. Starrett Company, as well as 12", 18", 24" 36" and 48" standard sizes in the new No. 254 line.

The one illustrated was built for Lockheed, to check missile components.

All the new gages have a long, flush-fitting vernier with open face design and 50 widely spaced graduations; fine adjustment knob on the base and a quick adjusting slide release.

The L. S. Starrett Company, Athol, Massachusetts.

Use postpaid card. Circle No. 37

### New Model Small Parts Comparator

A new Model C of the Wilder Small Parts Comparator is designed for rapid inspection of mass-produced parts. Its stage and screen are conveniently placed for maximum speed and comfort in inspection.

The instrument is furnished with basic equipment only. Depending on the type or size of the parts to be inspected, a variety of magnifications, measuring stages and master gage charts are available. The comparator illustrated is


# Planning To Reduce Costs?

## . . . on high speed grinding and finishing jobs

*Then Check On!*

## HOFFMAN "Narrow-Kerf" DIAMOND BITS

**Hoffman "Narrow Kerf"* Bits are currently in use for countless high speed operations on such materials as glass, marble, granite, ceramic, zac, monofrax pyroceram, etc.**

If low production costs and outstanding performance are important . . . then it will pay you to investigate the savings possible with Hoffman "Narrow Kerf"* Bits, available with Diamond Impregnated or Diamond Surface Set cutting faces, these bits will help you establish new standards of production and quality on items of the hardest materials known.

Actual performance records show one instance where Hoffman Bits are drilling 16,000 holes per bit on a glass job. On Ceramic Lamp Base drilling operation, Hoffman Bits last 5 times longer with less than .005" OD variance.

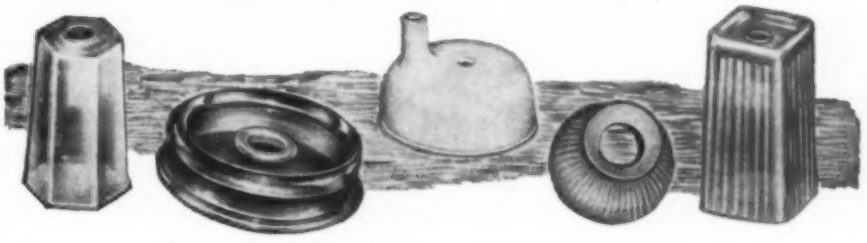
Because Hoffman designs every "Narrow Kerf"* Bit for the specific job . . . users are assured of the best possible performance. Tests are made from customer's material samples in Hoffman's Laboratories with full reports supplied to the customer.

Let Hoffman design a better bit for your coring work. Simply send a material sample for testing at NO OBLIGATION TO YOU.

Watch for new data soon to be released covering the success of Hoffman Bits in coring tungsten carbide, titanium, ferrous magnetite, etc.

*Represents Wall Thickness of Diamond Crown from .015" to .093".

Hoffman Bits Produce These and Similar Items At High Speed.



**Send for Literature and Prices . . . Ask about Sample Testing**

**HOFFMAN BROS. DRILLING COMPANY**

**102 CEDAR STREET PUNXSUTAWNEY, PENNA.**

Use postpaid card. Circle No. 241

equipped with special 2" x 4" range measuring stage with window reading micrometers in .0001". Catalog No. 357.

Opto-Metric Tools, Inc., New York, New York.

Use postpaid card. Circle No. 38

### Improved Angle Dresser

The improved "Mighty Midget" angle dresser is claimed to be low in cost, dust resistant and chatter resistant.

Contained in a honed housing that is easily adjusted for wear, the dresser is made with a hardened, fully enclosed, spring-loaded slide. Tested for over 50,000 strokes under a bath of grinding dust and lapping compound, the slide showed less than .002 wear.

Spring-loading the slide makes it more chatter resistant, as it provides a constant tension for the slide, a feature which is desirable for fine work.

The new slide unit is interchangeable with all old model units. There is no increase in price for the improved dresser.

Sperman Metal Specialties, Brooklyn, New York.

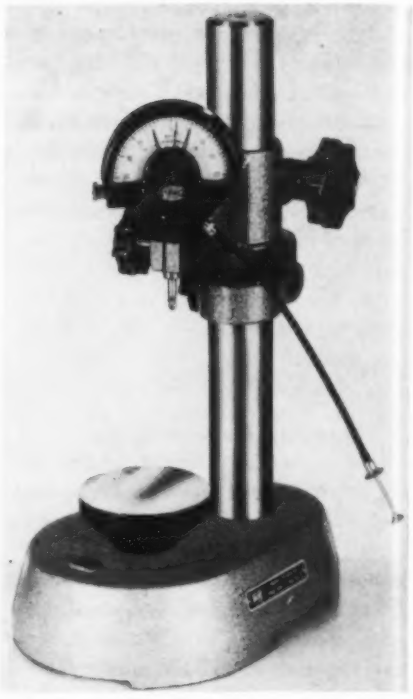
Use postpaid card. Circle No. 39

### New Dial Indicators, Stand

In a new line of indicators and an indicator stand, two models are now available.

One features direct readings in .00005" with a full range of dial of .004" and 20-0-20 graduations.

The second model has direct readings in .0005", .016" full dial range and 8-0-8 graduations.



Both models include, for the zeroing of the indicators, a fine cam-lock adjustment which cannot be disturbed by shocks or accidental contact with hands or objects.

Possible damage to indicator is prevented by an extra lift of 5/32" over the scale range. The mechanism is fully jeweled and shock proof.

A large variety of contact tips is available from stock.

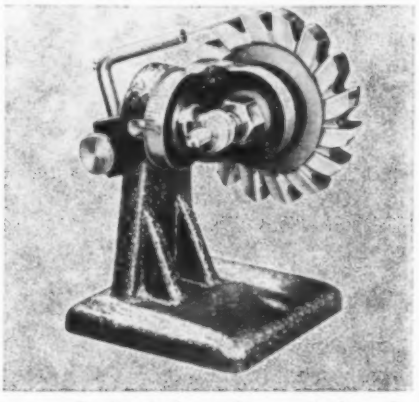
The .00005" model (No. 658) is $32.50, while the .0005" model (No. 657) sells for $16.00. The 6" capacity stand is $29.75.

George Scherr Co., Inc., New York, New York.

Use postpaid card. Circle No. 40

### Cutter Grinder Fixture

A new cutter grinder fixture makes it possible to grind and sharpen plain milling cutters up to 6" in diameter



on a horizontal surface grinder. In many shops, it is claimed, this will eliminate the need for a universal tool and cutter grinding machine.

PRECISION SPINDLE DIVISION

the STANDARD electrical tool co.

2478 RIVER ROAD, CINCINNATI 4, OHIO

ASTE SHOW
Detroit
Apr. 21 to 28
Booth 1430

Use postpaid card. Circle No. 242

The fixture is a meehanite casting, with all working surfaces hardened and ground.

Its overall height is 6"; weight, 5 lbs., and the base is 4" square. It will hold all plain milling cutters up to 6" in diameters, with bores of ⅞", 1" and 1¼".

Montgomery & Co., Inc., Newark, New Jersey.

Use postpaid card. Circle No. 41

### New Reflection Unit for Optical Comparators

A new normal reflection unit for all Jones & Lamson FC-14 and TC-14 optical comparators is now available. This new unit is designed to produce the maximum amount of reflectivity, regardless of the surface finish of the piece-part. Even superficial surface scratches can be checked accurately.

A front surface spherical reflector adds at least 55% to the effective light given by a 1200-watt lamp. The entire unit is externally mounted. All heat is dissipated before entering the optical system of the comparator.

A Pyrex heat-resistant lens in the reflection unit prevents breakage due to shock. Depth of focus up to .100" can be obtained. The image does not change size during focusing.

This new J & L unit can be installed either in the field or at the factory.

Jones & Lamson Machine Company, Springfield, Vermont.

Use postpaid card. Circle No. 42

### Fixture for Surface Grinders

The "Mini-Grind" is a fixture to be used on surface grinders. It has a direct-drive, variable-speed motor and complete cooling system plus an adjustable torsion clamping device that locks in a positive position.

With the fixture it is possible to grind external diameters in any form and size ranging from .005" to 3½". No chucking or indicating is required to hold concentricity and size.

Products Supply Company, Ferndale, Michigan.

Use postpaid card. Circle No. 43

### Gear Deburring Machine

The KOPING factory has released information on a semi-automatic gear chamfering and deburring machine, claimed to be unique in its field. Clusters of one to five gears can be worked in a single operation. The capacity is 7" swing on 16" centers.

Homestrand Machine Tool Corp., Greenwich, Conn.

Use postpaid card. Circle No. 44

**"Just between you and me, they've got it all over the other ones we've tried!"**

While there *are* other excellent brands, experienced operators consistently rate Jewel Brand Abrasive Belts best for grinding, smoothing and polishing. Worth trying! Order thru your Industrial Distributor today.

JEWEL

**COATED ABRASIVES**

*Belts • Rolls • Sheets • Discs • Specialties*

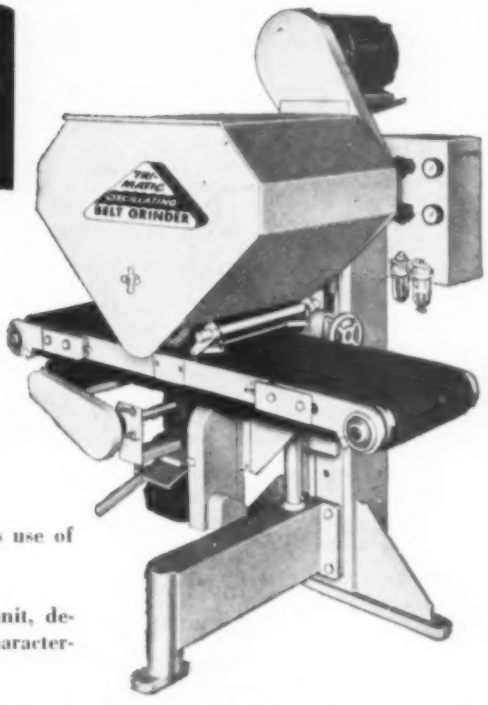
**ABRASIVE PRODUCTS, INC.**

South Braintree 85, Massachusetts

Use postpaid card. Circle No. 243

# NEW TRI-MATIC Oscillating Belt Grinder

## deburrs, descales, grinds, polishes . . . Change Abrasive Belts in LESS THAN 2 MINUTES




BELT TRACKING adjustments are completely eliminated by the Aer-Tronically Controlled belt oscillation. There are no projecting belt guides to interfere with changing or to fray belt edges. Just slide one belt off and another on. It takes less than 2 minutes from turning off the machine to re-starting.

4 MACHINE SIZES IN 1. A simple adjustment of the air jet sensing unit permits use of 6", 8", 10" or 12" wide belts.

EASY CHANGE CONTACT WHEELS. The contact wheel and mount are one unit, designed for easy changing. Where different jobs require different contact wheel characteristics the change can be made in a matter of minutes.

OSCILLATING BELT SPEEDS GRINDING, PROLONGS BELT LIFE. By imparting a shearing action, instead of a straight line push, the abrasive belt cuts faster, cleans itself better, reduces grinding pattern to a minimum and makes belts last longer. Variable speed conveyor adds to versatility.

*Write TODAY for illustrated, descriptive Bulletin TM-459*

Send your deburring, descaling, grinding, polishing problems to our abrasive engineers for their suggestions. No obligation.

**TRI-MATIC DIVISION**

**Sales Service Mfg. Co.**

**2365 University Avenue, St. Paul 14U, Minnesota**

Use postpaid card. Circle No. 244

**"I'm disappointed in you . . . you promised you'd give them a try the last time I called!"**

Why put off a good move? Call your Industrial Distributor or have one of our abrasive Engineers arrange a trial run of Jewel Brand Abrasive Belts *today*.

JEWEL BRAND

**COATED ABRASIVES**

*Belts • Rolls • Sheets • Discs • Specialties*

**ABRASIVE PRODUCTS, INC.**

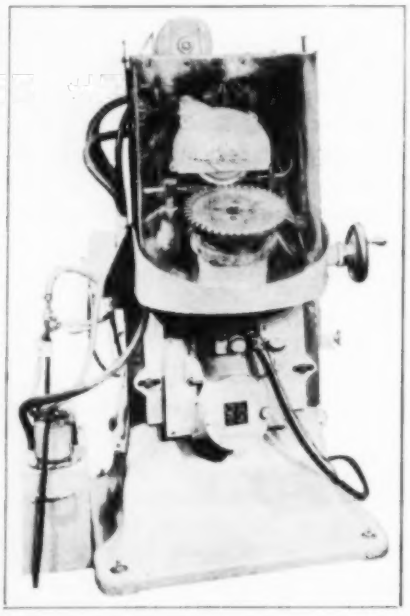
South Braintree 85, Massachusetts

Use postpaid card. Circle No. 246




### Electrically-Aided Grinding for Automatic Face Mill Grinder

The electrically-aided grinding process has recently been applied to an automatic face mill grinder.



The new combination produces substantial savings in diamond wheel cost and cutter life, improving finish.

In a completely automatic cycle the machine grinds the lead angle, corner radius, face radius and soft steel backing of inserted teeth. Tooth shape is controlled by a simple cam arrangement. Machine cycle time, on a given tooth, averages 29 seconds producing an approximate 8 microinch finish.

Four machine sizes accommodate face mills from 4" to 21" in diameter. The face plate indexes automatically and can be set for 8 or more teeth.

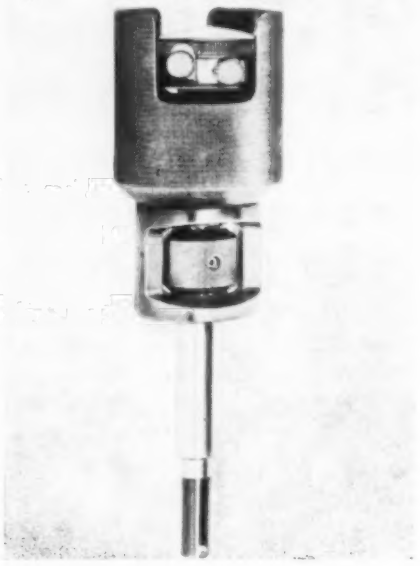
The machine operates hydraulically. Machine set-up time for various cutters takes approximately 5-10 minutes.

Oliver Instrument Company, Adrian, Michigan.

Use postpaid card. Circle No. 45

### New Hole Location Gage

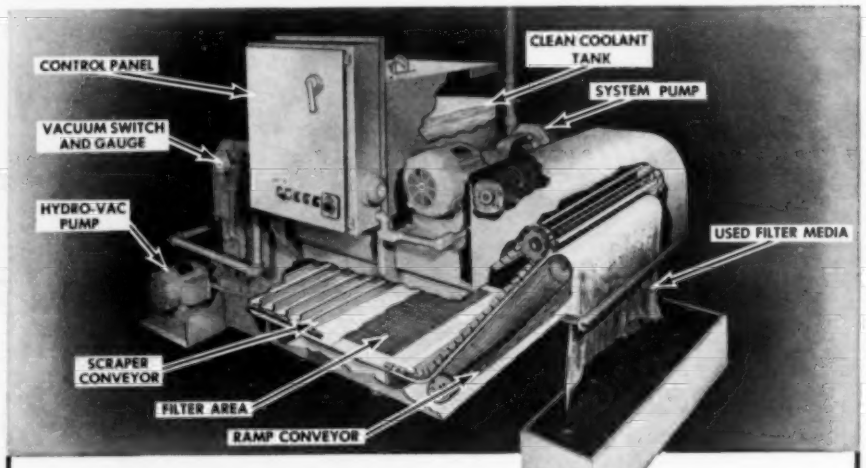
The new model CC-100-V hole location gage has the indicator axially centered and recessed in the head of the gage so that indicator is read directly in line with the hole being checked. Reading the indicator when checking holes at bench level is also easier.



Like other gages in the Mayes Tool Co. line, the ground and lapped pilot member remains stationary in its locating hole while a knurled thumb knob is rotated to actuate an indicator finger that checks runout on other hole. This minimizes wear on the pilot.

Mayes Tool Co., Pleasant Ridge, Mich.

Use postpaid card. Circle No. 46


**AUTOMATION IN FILTRATION!**

- Completely automatic operation
- Used with individual machines
- Compact — with low liquid inlet
- Low operating cost
- Fine degree of filtration
- Pressure and vacuum forces act on filter media
- Any coolant — any sludge

**HYDROMATION FILTER CO.**

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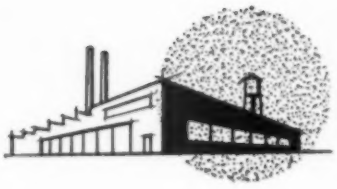

# News from the Industry

## 3M Announces 14-Story Office Building

**Minnesota Mining and Manufacturing** Co., of St. Paul, Minnesota, recently announced the beginning of construction of a 14-story office building to be completed in 1962.

The structure is located on a 265-acre tract just east of St. Paul. Finished, it will add 520,000 square feet to the company's facilities at this administrative-research center.

The site was originally planned, about ten years ago, as a research center. A 125-acre area was purchased, and early in 1953 plans were announced for the first building on the tract. Administrative buildings were added to the concept when it became evident that expansion possibilities at the company's present location could not keep pace with its growing needs.

To date, seven buildings totaling 560,000 square feet have been completed. Additions and two new buildings now under construction will add another 205,000 square feet in 1960. The completion of the new office building will bring total new construction at the site up to a million and a quarter square feet by 1962.

## Huge Bearings for N. S. Savannah

Huge special ball thrust bearings designed and manufactured by **The Kaydon Engineering Corp.**, Muskegon, Michigan, will be used to install the fuel elements in the nuclear reactors of the N. S. Savannah, the world's first atomic cargo-passenger ship.

Two bearings of 106" and 64" diameter will be installed in the mechanism called the "charging plug," which rotates in order to locate the refueling cask in the various positions necessary to load the fuel core.

Close tolerances are held in order to obtain parallel surfaces and accurate concentricity of these bearings. To meet the critical tolerances imposed on these and other bearings up to 15' in diameter, Kaydon uses special two-head precision grinders developed by its Frauenthal Division.

## SKF Buys 12-Acre West Coast Site

Purchase of a 12-acre tract of land in Hawthorne (near Los Angeles), California, was announced recently by **E. R. Broden**, president and chairman of the board of SKF Industries, Inc.

SKF, celebrating its 50th anniversary, acquired Reed Instrument Bearing Co. last January. The company also has a warehouse in Los Angeles.

## Fairless Award to C. M. White

**Charles M. White** chairman of the board and chief executive officer of Republic Steel Corp., has been chosen to receive the 1960 Benjamin F. Fairless Award.

Honoring Mr. Fairless, former U. S. Steel head, the award is made by the American Institute of Mining, Metallurgical and Petroleum Engineers. It will be presented at the annual meeting of AIME in New York City, February 14-18, 1960.

## Carborundum Sets Up Technical Branch for Bonded Abrasives

**Leon A. Patt**, vice president of the Carborundum Bonded Abrasives Division, announced recently that all technical and engineering functions of the

"That's right, son . . . I wouldn't change for all the tea in China!"

**Loyalty** is a common trait among Jewel Brand Abrasive Belt users. Once you've tried them, it's easy to see why. Job after job, year after year, they never let you down. Try 'em and see!

JEWEL BRAND

COATED ABRASIVES

*Belts • Rolls • Sheets • Discs • Specialties*

ABRASIVE PRODUCTS, INC.

South Braintree 85, Massachusetts

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## NEWS OF INDUSTRY *continued*

division's Niagara Falls operations have been combined in a new Technical Branch.

**Fred Upper**, formerly division manager of product engineering, heads the unit. Assistant manager is **Stanley D. Mark**, formerly a supervising engineer in research and development.

### Abrasive Sales Manager Retires

**George A. Park** has retired as sales manager of abrasives at Norton Company after a business career of 50 years.

On the completion of 40 years of service, Mr. Park was presented a certificate by the Grinding Wheel Institute in recognition of his years of devoted service.

### Executive Promotions at 3M

A series of executive appointments affecting staff activities and the coated abrasive sales organization have recently been made known by Minnesota Mining & Manufacturing Co., St. Paul, Minnesota.

**C. P. Pesek**, vice president for engineering and staff manufacturing, has been elected to the board of directors and the executive committee.

**John J. Verstraete, Jr.**, moves up to the position of director of communications. He was formerly in charge of institutional publicity.

In the coated abrasive division, **F. M. Metcalfe** has been named division sales manager and **C. L. Murphy**, division marketing manager. **W. E. Marsden** succeeds Metcalfe as Eastern regional sales manager.

Prior to their present appointments, Murphy was industrial trades sales manager and Marsden, automotive sales manager.

The appointments were announced by **R. L. Ackerberg**, division general sales and marketing manager.

### American Buff Buys Siefen

Purchase of the **J. J. Siefen Company** of Detroit has been announced by **Ben P. Sax**, chairman of the board of the American Buff Company, Chicago, Ill.

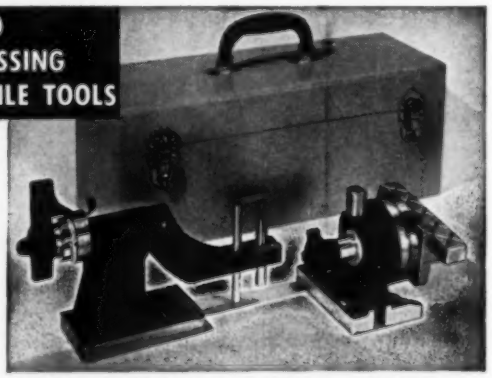
The Siefen Company, manufacturer of buffing compounds and spray equipment for the metal finishing industry, will retain its separate identity, continuing to operate separately.


Now ANGLE TANGENT TO RADIUS WHEEL DRESSING WITH NEW VERSATILE TOOLS

MIGHTY GOOD AT ANY PRICE BUT TOPS AT ONLY $149.50

*(Both tools including diamonds)*

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.



*Our fixtures will dress most radii and angles tangent to each other, similar to those shown below.*

**FREE** handsome, wooden storage box. Write for complete information.

PURCHASE EITHER TOOL SEPARATELY

Now you can purchase either the G-5 Radius Dresser or the G-2 Angle Dresser and Tool Holder separately if you so desire. (Without storage boxes)

G-5 Radius Dresser complete with diamond $80.00.

G-2 Angle Dresser and Tool Holder complete with diamond $87.50.

Replacement diamonds are always available for our units at a reduced price. Diamonds for the G-2 $5.00 each; diamonds for the G-5 $8.00 each.

Distributorship available in select territories

ROTHFUSS TOOL COMPANY

BOX 2696, ELMWOOD STATION PROVIDENCE 7, R. I.

Use postpaid card. Circle No. 248

St. Louis' luxury in-town motel

150 modern rooms • completely air conditioned • FREE 21 in. TV and radio • heated swim pool • baby sitters • room service • FREE PARKING • conference and small convention facilities

the new home of HENRICI'S renowned Chicago restaurant

MASTER HOSTS

FO 7-1235

BEL-AIR Motor Hotel

4630 Lindell Blvd., at Euclid

in the heart of St. Louis

Use postpaid card. Circle No. 261

The company has field offices in Chicago, Ill.; Cleveland, Ohio; Los Angeles, Calif.; Syracuse, N.Y.; Beloit, Wis.; Flint, Michigan and Hamden, Connecticut.

### Taft-Peirce Air Gages To Be Made in West Germany

Taft-Peirce instrument gages will be manufactured and sold in Europe by Hommelwerke, Mannheim-Kaefertal, West Germany, under a license and royalty agreement, according to a recent announcement.

The Hommelwerke organization is a leading manufacturer of gaging equipment and machine tools. Three models of the CompAIRator line of Taft-Peirce air gages in both single and multiple-dial units will be sold throughout Western Europe.

### Brightboy Appoints Canadian Representatives

Giles Tool Agencies, 135 Beech Avenue, Toronto, has been appointed as Canadian sales representatives for the Weldon Roberts complete stock line of Brightboy soft rubber bonded abrasives.

Brightboy Industrial Division sales manager, **Edward A. Shaw** will work closely with Giles in assisting distributors and their customers.

### Sheffield Official Attends Japan Conference

**Jack T. Welch**, vice president and sales manager of The Sheffield Corporation, a subsidiary of Bendix Aviation Corporation attended the Business International Japanese Roundtable, Tokyo, November 23-28, as special assistant to the vice president of foreign investments and plants of Bendix.

Some 50 American executives met with Japanese trade ministers, bankers, and industrialists to exchange views on trade relations.

### New West Coast Representative

**Harry K. Shackelford** has been appointed as industrial-automotive sales representative in the San Francisco sales district by The Black & Decker Mfg. Co., Towson, Maryland. He replaces **Harry Ohlson**, who has resigned.

### Slocum Elected President of International Resistance Co.

The appointment of **Walter Ware Slocum** as president of **International Resistance Company** was announced recently by **Charles Weyl**, former president who now becomes chairman of the board. Weyl in turn succeeds **Ernest Searing**, who is retiring.


# revolutionary

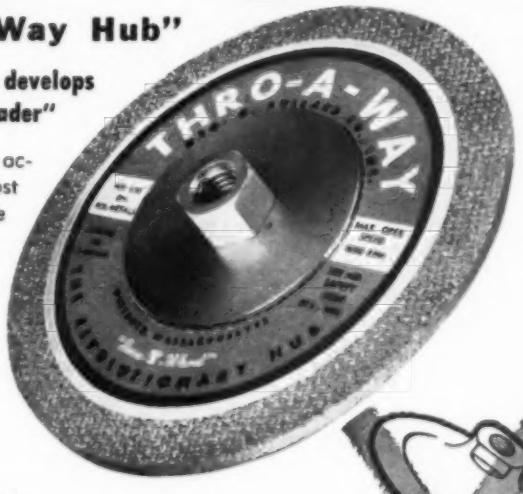
## the "Throw-A-Way Hub"

**The birth of an "idea" develops into an unchallenged "leader"**

A design and construction accomplishment that insures cost reduction to small and large users — Performance outstanding.

The "Thro-A-Way" is **safer — more rugged — faster.** Only one specification manufactured for metal removal. No inventory "build up problems".

For use on all right-angle grinders pneumatic or electric. Withstands greater peripheral speeds.




ELIMINATES:

Geo. H. Bullard

COMPANY INCORPORATED

ABRASIVE PRODUCTS WESTBORO, MASS.

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SEND FOR CATALOG G

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STREET

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# RAISE GRINDING PRODUCTION

FOR $2.70

A typical Desmond Huntington grinding wheel dresser costs about $2.70 from your distributor, yet it substantially increases grinding production, makes wheels cut better, and lowers grinding costs. By dressing all your grinding wheels regularly you remove inefficient dull particles and loaded metal, expose a fresh new grinding surface. Your Desmond distributor can furnish the exact model you require. Ask his advice.

*The only complete line of grinding wheel dressers and cutters*

**Desmond**

The Desmond-Stephan Mfg. Co.
Urbana, Ohio

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# 3000% more Grinding/Finishing/Polishing production!

Resilient, air-inflated VALCORE wheel flattens at point of contact, providing up to 30 times more abrasive contact area than other type grinders. More abrasive against the work means increased production.

You can boost grinding, finishing or polishing output up to 3000% on flat work, 600-700% on contours, by backing up your coated abrasives with VALCORE inflated wheels. Resilient contact drum puts more abrasive against the work . . . absolutely prevents band slippage . . . eliminates undercuts . . . avoids chatter and bounce . . . produces straight-pattern finish. Use VALCORE on portable tools or benchstands for all abrasive operations from moderate stock removal to fine micro-finishing.

*Send NOW for Free Catalogs on NU-MATIC VALCORE Wheels and FLEXCORE Expanding Wheels*

**NU-MATIC GRINDERS, INC.**
875 East 140th Street • Cleveland 10, Ohio
DETROIT: UNiversity 3-3376 • NEW YORK: BArclay 7-0196
CHICAGO: TUxedo 9-4300
CANADIAN DISTRIBUTOR: Wm. Orlick, Ltd., Hamilton, Ontario
**Use postpaid card. Circle No. 251**


## NEWS OF INDUSTRY *continued*

J. W. Seavy

### Mid-West Names Sales Managers

Two new field sales managers have recently been selected by the Mid-West Abrasive Company, Owosso, Mich.

**Judd W. Seavy** becomes district sales and service manager of the High Point, North Carolina region. He has been in the coated abrasives division of the company for the past seven years.

**Carleton D. Cole,** associated with abrasives in the Detroit area for 21 years, is now regional manager of the Detroit office.

C. D. Cole

### Bay State Adds to Cleveland Sales Force

**James G. Moses** has joined the Cleveland sales organization of Bay State Abrasive Products Company, Westboro, Mass., according to an announcement by **George H. Smith,** Cleveland district manager.

Mr. Moses was formerly with Simonds Abrasive Co.

J. G. Moses


# SOPKO Grinding Wheel ADAPTERS

TOOLROOM ACCESSORIES

FREE Catalog

- For Use on All Popular Surface Tool and Cutter Grinders
- Precision-made, Hardened & Ground with Heat Treated Nuts
- Complete Line—4 New Models of Adapters Available
- Large Stocks—Immediate Delivery

SOPKO ADAPTERS Save Time and Money

**Write for CATALOG and PRICES**

**WM. SOPKO & SONS CO.**
**140 E. 267th ST. • EUCLID 32, OHIO**

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New
# RAMPE 30 x 48
## cuts big-job finishing costs

Real cost-saving is only part of the story with this newest, most productive Rampe machine. In 30 x 32 or 30 x 48 sizes, with one to three compartments, it gives you broad usefulness, simple operation, and the rugged dependability recognized in all Rampe precision finishers. Variable speed drive 8 to 25 rpm, "No-Seam" vinyl-lined barrels, and a wide selection of control accessories give real flexibility. Find out how you can cut costs . . .

***write for details on Model 30x32 or 30x48 today.***

**RAMPE MFG. CO.**
14915 WOODWORTH AVE., CLEVELAND 10, OHIO

**Use postpaid card. Circle No. 253**

W. T. Alderson

### Ingersoll-Rand Elects Vice President

Ingersoll-Rand has elected **W. T. Alderson** vice president, according to an announcement by **R. H. Johnson**, chairman. Alderson was previously manager of the company's compressor engineering department. He will be located in Ingersoll-Rand's executive offices.

Alderson is a veteran of over 30 years with Ingersoll-Rand.

McLaughlin

### American Forge Names McLaughlin

**Harry W. McLaughlin, Jr.**, has been appointed secretary and assistant to the president of American Forge and Manufacturing Company, McKees Rocks, Pennsylvania, manufacturer of forgings and material handling equipment for heavy industry.

Prior to joining American Forge in 1952, he had been with United Engineering and Foundry Company in Pittsburgh for ten years.

A. J. Kirchner

### New Ex-Cell-O Export Manager

The appointment of **Andrew J. Kirchner** to the position of manager, export sales, has been announced by **D. H. McIver**, vice president, industrial sales, Ex-Cell-O Corporation, Detroit.

Kirchner succeeds **Stewart J. Elliott**, who retired September 30.


# ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

Use postpaid card. Circle No. 255

## the FORM-ALL TWO ANGLE TANGENT TO RADIUS DRESSER

the finest for geometric forms

PATENTED

Write for brochure No. 2

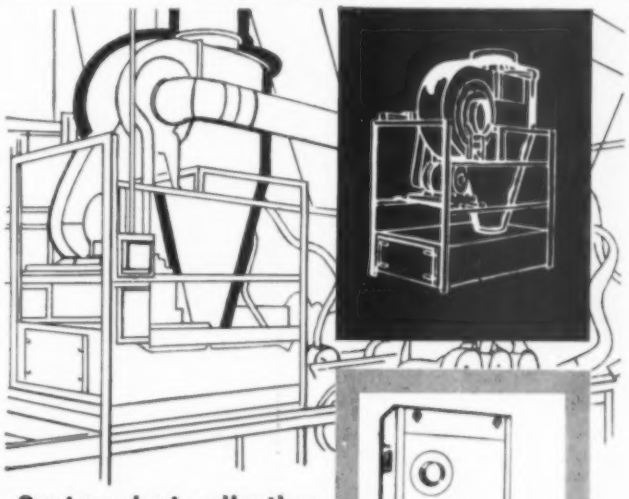
- EXTRA LARGE RANGE
- ONE MINUTE ANGULAR SETTINGS
- STRAIGHT LINE DRESSING

Note:
For Unlimited Contour Dressing on any machine Write for "CONTOUR REX" Brochure No. 1

## FORM-ALL MFG. CO.

LONG VALLEY, NEW JERSEY

Use postpaid card. Circle No. 254



## Custom dust collection —with a standard unit . . .

Regardless of your dust collection problem, chances are there is a space-saving Dustkop model to fit the job. Aget, for years, has led the field in efficient, compact design and has developed more than 50 standard Dustkop collectors. Each is job-tailored to most grinding, buffing or finishing operations—as well as many other types of service. Write for illustrated brochure that helps select your tailored Dustkop unit.

Also a complete line of mist collectors

AGET MANUFACTURING COMPANY DUSTKOP Stops Dust
1300 EAST CHURCH ST., ADRIAN, MICHIGAN

Use postpaid card. Circle No. 256

# MAKE MAGNETS

## AN IMPORTANT PART OF YOUR MONEY-SAVING PROGRAM

### To Cut Production Costs and Improve Efficiency

More and more manufacturers are using Empire Permanent Alnico Magnets in conveyor systems handling parts through virtually every phase of production.

Irregular shapes are easily handled without the use of hooks for degreasing, painting and plating. Parts are held in place by magnets for various machining operations or for assembly and inspection. Magnets are used to hold safety shields in place . . . for sheet steel separators and as retrievers in deep tanks.

First cost is the last cost. No electric energy, wiring or maintenance is required.

WRITE FOR COPIES OF "MAGNET IDEAS"
these leaflets show many practical uses of Empire Magnets to cut production costs.

EMPIRE MAGNETICS INC.

113 E. Clinton St.
Maumee, Ohio

Use postpaid card. Circle No. 257


## NEWS OF INDUSTRY *continued*

### Kinnard Appointment Announced

**Richard W. Kinnard** had been moved up to the position of manager, finance for General Electric's Metallurgical Department, according to an announcement by **Dr. C. E. Reed**, general manager of the Department. Since 1955, Kinnard had been audit administrator.

R. W. Kinnard

### Strom is New Roto-Finish Process Engineer

The appointment of **John R. Strom** as chemist and process engineer at Roto-Finish Company, Kalamazoo, Michigan, was recently announced by **Gunther W. Balz**, president of Roto-Finish.

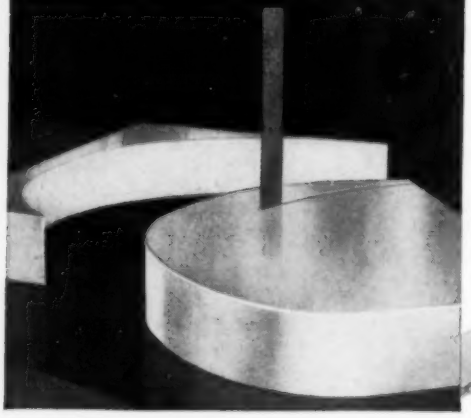
J. R. Strom

### W. W. Sly Rep Transferred

**John J. Finnerty** has been transferred to Chicago as a sales representative for the W. W. Sly Manufacturing Co., Cleveland, Ohio, manufacturer of dust control systems, blast cleaning equipment and tumbling mills.

J. J. Finnerty


## Diamond Coated Band Saw Blades



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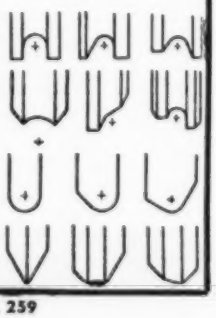

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# Don't Miss these Features

# GRINDING and FINISHING

CONTENTS FOR JANUARY 1960


**30 "Bubble" Wheels for Soft Non-Metallics**
Molding of alumina bubbles into wheels expands grinding wheel applications into area of soft materials where loading has long been a problem.

**34 The State of the Industry**
Direct quotations from the top men of the grinding and finishing industry—the heads of the leading companies in the field—as to the outstanding events of 1959 and the sales and technical outlook for 1960.

**41 Detroit Broach Eliminates Burning, Loading with Wheel Treatment**
First definitive report of results with a new wheel treatment which has eliminated burning and loading, saved man hours and extended wheel life.

**43 Slash Costs with Flat Polishing**
Abrasive belt polishing, usually regarded as a high-volume process, has become a flexible and highly economical stock removal and finishing operation for medium and small plants.

**46 Standard Time Data for Grinding—Part II**
Application of standards techniques to large surface grinding operations commonly known as Blanchard grinding.

**52 Right-Size Wheels Cut Grinding Costs**
Are you paying for abrasive you never get, buying fancier shaped wheels than you need? You may be, if you haven't taken a hard look recently at the sizes and shapes you are purchasing. Six ways of saving money on grinding wheels.


## Coming Next Month

**The Honing Process**
What, precisely, is honing? How does it fit into the broad field of metal removal and finishing? What are its possibilities? Its limitations? All these and many other questions about honing are answered in this basic treatment, with material from the leading companies in the field. Part I of a four-part series.

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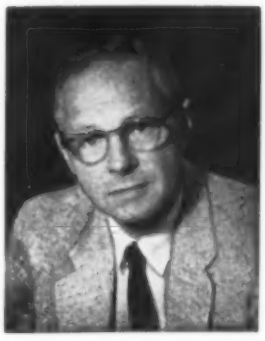
# Index to Advertisers


| | | |
|---|---|---|
| 71, 72, 74 | Abrasive Products, Inc. |
| 22 | Action Diamond Tool Company |
| 77 | Aget Manufacturing Company |
| 62 | Airborne Instrument Laboratory, Division of Cutler-Hammer, Inc. |
| 80 | A.I.T. Diamond Tool Company |
| 12 | Almco, Queen Products Division, King Seeley Corporation |
| 20 | American Chain & Cable Co., Allison Division |
| 27 | Aro Equipment Company |
| 55 | Barnes Drill Company |
| 14 | Barton Mines Corporation |
| 80 | Bates Abrasive Products, Inc. |
| 10, 11 | Bay State Abrasive Products Company |
| 74 | Bel Air Motel |
| 32 | Blanchard Machine Company |
| 75 | Bullard Company, George H. Inc. |
| 15 | Carborundum Company, Bonded Abrasives Div. |
| 24 | Carborundum Company, Electro Minerals Div. |
| 2, 3 | Cincinnati Milling Machine Company, Grinding Machines Division |
| 17 | Cincinnati Milling Machine Company, Grinding Wheels Division |
| 16 | Crafts, Arthur A. & Company, Inc. |
| 6 | Crane Packing Company |
| 75 | Desmond-Stephan Manufacturing Company |
| | DoAll Company—Inside Back Cover |
| 78 | Empire Magnetics |
| 28 | Exolon Company |
| 77 | Form-All Manufacturing Company |
| 82 | Gallmeyer & Livingston |
| 68 | Hammond Machinery Builders, Inc. |
| 26 | Harig Manufacturing Company |
| 56 | Hill Acme Company |
| 69 | Hoffman Brothers |
| 72 | Hydramation Filter Company |
| 64 | J & S Tool Company |
| 78 | Jeon Manufacturing Company |
| 78 | Kay & Warren Company |
| 67 | Kirk & Blum Manufacturing Company |
| 30 | Kuzmick, Paul L. Company |
| 77 | Lee, K. O. Company |
| | Macklin Company, Inside Front Cover |
| 23 | Manhattan Rubber Division, Raybestos Manhattan, Inc. |
| 7, 60, 61 | Micromatic Hone Corporation |
| 76 | NuMatic Grinders |
| 31 | Pekay Abrasives Company |
| 76 | Rampe Manufacturing Company |
| 23 | Raybestos Manhattan, Inc., Manhattan Rubber Division |
| 74 | Rothfuss Tool Company |
| 8 | Roto Finish Company |
| 71 | Sales Service Manufacturing Company |
| 78 | Sample Marshall Laboratories |
| 18 | Simonds Abrasives Company |
| 59 | Smit, J. K. & Sons, Inc. |
| 76 | Sopko, William & Son |
| 66 | Speedlap Corporation |
| 70 | Standard Electrical Tool Company |
| 33 | Sundstrand-Engelberg Division, Sundstrand Corporation |
| 65 | Torit Manufacturing Company |
| 4, 5 | U.S. Diamond Wheel Company |
| | U.S. Rubber Company—Back Cover |
| 58 | White & Bagley Company |

# A Final Thought

## Poor Quality: Whose Fault?

Product reliability, or high product quality, are the responsibility of management. If the product is below par, or downright poor, management and management alone must bear the censure of the consumer. The designers, engineers and workers are but instruments of management, or at least an extension of management, and it is through them that management's views are translated into autos, refrigerators, television sets, generators, etc. If management is sincerely interested in good quality, rather than give it mere lip service, then the end result will show up in the TV set, washing machine, dryer, auto or tire. If, on the other hand, management believes that cost and price is the alpha and omega of business then the product will be merely one step above junk and not worthy of consideration by the consumer.



Management may well point to its quality control department as the final authority in this matter; however, this is open to question, especially by the quality control department. Can you imagine what would happen if q.c. found a defective system in one out of ten dryers. Do you think management would hold up an entire warehouse full of dryers until each one was tested, especially if dealers were clamoring for delivery? Of course not! Management would say, it's only one out of ten, the servicemen will straighten it out quickly enough. Too often q.c. is organized to merely prevent scrap, to correct faulty machine work, at the same time neglecting the over-all quality of the finished product. The perfection of the units does not assure the perfection of the whole. No one knows this better than the aircraft and missiles people who have been concerned with quality control on a piece part basis as well as on an over-all systems basis for many years. The auto boys would do well to look into this matter.

The quality control department reflects management thinking in its work even though this is one department which should be autonomous, a high priest of excellence. Absence of quality thinking at the top is reflected in a devil-may-care attitude at the bottom. Unless quality permeates the organization from the top down, little importance can be achieved.

The quality of American products is deteriorating rapidly. From a $4,000 auto down to a $400 appliance: Once you've bought either of them the service man has a mortgage on your income and he's ready for his cut. Not once, but for evermore. If you want the item you've gone into hock for, be sure you've got a cache to handle the service bills.

The situation is disgraceful, all the more so because designers, engineers and workers can produce excellent products. But so long as cost and price, and they alone, dictate managerial thinking, so long will our products remain third-rate. However, many people are beginning to be aware of the quality of foreign goods. If management should also become aware of it there may be hope.

Wm. J. Schleicher

Vice President & Editorial Director

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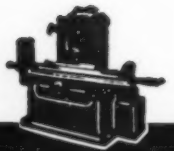

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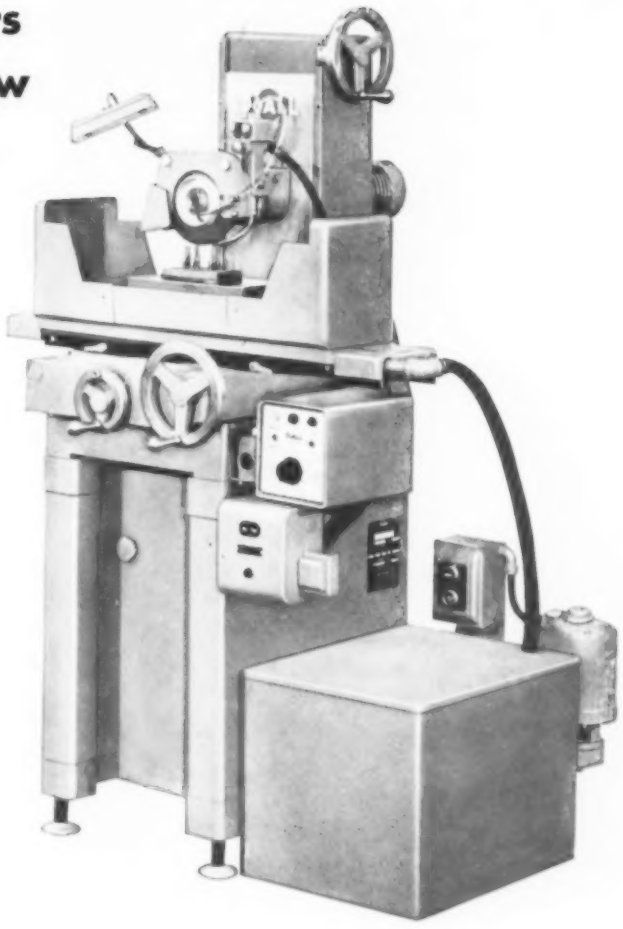
# No other manual grinder offers so many advantages as the new DoALL Model DH-612



You've never seen a manual surface grinder with such accuracy, convenience and all-around flexibility as the DH-612. Compare it with all the rest—and see.

**Accuracy**—The DH-612 grinds to closer tolerances than others in its class. It is easy to grind accurately to handwheel calibrations—vertical feed to .0001" and cross feed to .0002". The 1 h.p. motorized or belt-driven, permanently lubricated, anti-friction bearing spindle provides steady, precise grinding action. There is no table climb because the saddle ways support the entire work area to the extreme ends of the table travel.

**Convenience**—Machine height can be adjusted for individual operators. The table drive handwheel can be easily moved for left- or right-hand operation and the wheel handle positioned to suit the operator. A one-shot lubricator oils all moving parts.

**Flexibility**—A complete line of attachments includes a downfeed handwheel extension to bring all controls within easy reach of a seated operator, also "Cool Grinding" coolant system, and hydraulic table operation. The grinders leave our factory prepared to accept these attachments at any time in the customer's plant.

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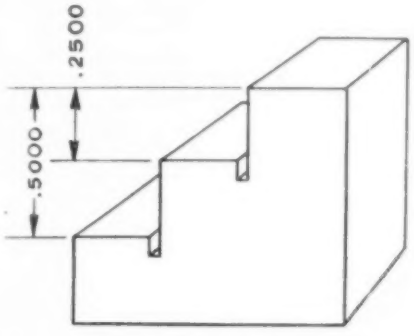


"Hardened tool steel step block"

The DH-612 grinds this step block directly from handwheel calibrations to "tenth" accuracy. This eliminates the grind-and-measure techniques commonly used. This impressive demonstration is one of many performance features that make the versatile DH-612 grinder outstanding.

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Table travel: 7" x 13"
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Vertical-feed handwheel graduated in tenths
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"U.S." Grinding Wheels installed on Naxos-Union roll grinder.

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